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Federal versus State Regulation

The extent to which public sentiment has crystallized in favor of federal regulation of railways to the exclusion of state regulation is indicated in a remarkable way by the planks on the subject of transportation placed in their platforms by the Republican and Progressive parties. The Republican platform declares unequivocally for exclusive federal regulation, even if a constitutional amendment be necessary to secure it. The Progressive platform says that with respect especially to transportation and foreign trade only the federal power can work justice to both capital and labor throughout the nation, and that only the national authority can mobilize industry for defense as the nation's needs demand. Such statements are incompatible with a belief in state regulation of railways. Some of the ablest leaders of the Democratic party already have explicitly conceded that state regulation interferes with federal regulation, thereby doing more harm than good, and should be completely subordinated or abolished. There seems, therefore, reason for hoping that the Democratic convention will take action similar to that taken by the Republicans and Progressives. Nobody who has studied the question with reference solely to the needs and welfare of the nation can entertain a doubt that state regulation, as a force for good, is played out; and the needs and welfare of the nation include those of all the states, as the whole embraces all its parts.

The Chamber of Commerce Referendum

By an almost unanimous vote, the Chamber of Commerce of the United States has adopted a resolution asking Congress to direct the Interstate Commerce Commission to investigate at once certain phases of the threatened interruption of railroad traffic of the country. By threatened interruption of railroad traffic is meant, of course, the strike of the four brotherhoods of train employees unless their pay is increased by the adoption of a basic eight hour day. The Chamber of Commerce of the United States represents the business men, shippers and travelers—in other words, the consumers of railway transportation. As was so well brought out in the paper by Charles Nagel, former Secretary of Commerce, which was printed in the *Railway Age Gazette* last week, in either mediation or arbitration the interests of both the unorganized employees and the general public have been conspicuously disregarded. The action of the Chamber of Commerce of the United States is, therefore, of great importance. It is an active recognition of the vital interest which the shippers and traveling public have in this dispute between the employees and the railroads, and is an assumption of responsibility for those interested by a body which can and undoubtedly will command the respect of Congress.

One Reason Why

Under the caption "Why Railroads Are Distrusted," a former commuter from Norristown, Pa., writes to the Philadelphia North American complaining bitterly that he now has to pay 84 cents a roundtrip from Norristown to Philadelphia, whereas for 25 years he was a commuter with a 27-cent roundtrip rate (assuming that he used all of his 60 rides each month). He is no longer a commuter because he has retired from business and only goes into the city occasionally. He says among other things: "The railroads have given the public unequal, illiberal, foolish, restricted service and both the railroads and the public have suffered." Norristown is 17.6 miles from Philadelphia. If the Norristown commuter had paid two cents a mile, making 25 roundtrips a month, during his 25 years, his monthly commutation would have been $17.50 instead of the rate which he actually paid—$8.10. In other words, the railroad gave him service which cost *him* $2,820 less than the lowest rate which even a state commission has urged as being barely compensatory to a railroad. The former commuter scoffs at the idea that there could be a difference between the cost of carrying commutation business and ordinary business commensurate with the difference between 27 cents and 84 cents. The average number of passengers per train-mile in commutation service out of Philadelphia probably runs at least as high as 500. An average of 70 passengers per ordinary train-mile is high. The cost per train-mile for running a commutation train is not greatly different from an ordinary local. The receipts per train-mile at 2½ cents a mile for the ordinary local averaging 70 passengers would be $1.75. The receipts per train-mile from the commutation train would be over $4.00. Here is a man who has benefited for 25 years by the scientific application

of an economic principle of transportation, which really makes two blades of grass grow where one grew before, and who is now "hot" every time he buys a roundtrip ticket to Philadelphia. Is it not hopeless to try to educate a man like this?

"PRODUCTIVE EFFICIENCY" ONCE MORE

IN the hearings concerning coal rates that have been conducted recently by the Interstate Commerce Commission the coal shippers have presented data which call for a reduction in coal rates on the ground that increased productive efficiency since the last coal rates were established entitles the shippers to a diminution of their charges. Productive efficiency is a most seductive source of all good things for shippers and employees. It appears to be a gold mine which the railways by some process of alchemy are continuously developing and from which one interest after another can draw what it wants for its own delectation. At one time it is the freight engineers, at another it is the passenger engineers; again it is the firemen, the conductors, the brakemen, and baggagemen; and now it is the shippers—all are entitled to share in this mystic Monte Cristo treasure known as "productive efficiency," which all have by some mysterious unconscious process of co-operation helped to create.

Let us refresh our minds on the argument as it has been applied to the wages of employees. The most complete presentation was made in arbitration of the wages of enginemen and firemen in Western territory a little over a year ago. Without following the argument in detail or noting the various modifications and concessions made by its defender in his cross-examination, it is sufficient for our purposes to state it in summary form. Accepting ton-miles and passenger-miles as indicative of the output of the railway plant, the number of ton-miles and the number of passenger-miles per $1,000 of compensation for any class of employees will indicate the cost of securing the output so far as this class of employees is concerned. If between an earlier and a later year the number of ton-miles or passenger-miles per $1,000 of compensation has increased, it is proof that the productive efficiency of this particular class of labor has increased and that therefore it is entitled to an increase in wages corresponding to its increase in productive efficiency. This argument has been carried more recently to the point of insisting that the brotherhood employees have accumulated a large amount of productive efficiency for which they have not yet been compensated—"back pay" which their organizations propose to collect by whatever device is most effective at the time. The public is familiar with the argument that wages should be advanced on the ground that other occupations of similar skill and responsibility are generally better paid. It has frequently heard the argument that increased cost of living is a reason for increased wages. It is not unfamiliar with the general claim that employers should share with their employees the increase in prosperity of their business or the benefits of technical progress in the industry. But that specific classes of employees should have their wages increased by a specific amount because these particular employees, independently of all others, have increased their contribution to the output of the enterprise, and that this increase can be measured by relating the entire output of the business to the compensation of the particular class, is a proposition of such amazing presumption that we simply cannot understand how it has imposed itself upon anyone.

Let us look it squarely in the face for a moment. Here is a great railway plant performing its function of carrying passengers and freight. It is primarily a public servant. Beyond a rigidly limited rate of return, the proprietors are entitled to nothing. The obligation of this railway to the public, as well as the dire necessity of making ends meet, forces it to introduce every possible means of making its plant more efficient. Capital is poured in continuously for the extension and improvement of its facilities. The staff and working force is being constantly adjusted, improved, strengthened, developed with the object of turning out the product with greater efficiency and at less cost. As a result output is increased and expenses per unit of output diminished. Net returns are thereby enhanced. A goodly part of this increased net return has already been ear-marked and must be devoted to the payment of interest on the additional capital that made the increased output possible. The plant being now more valuable, the state descends upon the road and takes additional toll in the form of increased taxes and this must be provided from the increased earnings. Both of these claims are imperative and predetermined. If it so happens that out of the increased net earnings there is still something left available to the stockholders, this increase alone represents that increase in "productive efficiency" upon which the various claimants mentioned at the beginning of this discussion have any right, if at all, to draw. For, mark you, productive efficiency cannot be measured by output alone. There must be an increase in net return over the cost of doing the business if we are to talk of increased productive efficiency.

Now comes the question, To whom does this increase in productive efficiency belong? There is first the staff of executives which has moulded the present efficient organization and has furnished the enthusiasm and stimulus for its efficient working. But, it is argued, the staff was secured to do and is compensated for doing exactly this thing. Hence, it is not entitled to any share in the increased efficiency. We will grant this for the sake of the argument and proceed. Then appears the statistical attorney for the Brotherhood of Locomotive Engineers, in a demand for an increase in wages, and argues that, because wages of this class have not kept pace in their percent of increase, not with increased returns available for distribution to stockholders, not even with total net returns, but with total ton-miles and passenger-miles, there is, therefore, a large fund of productive efficiency owing to the locomotive engineers which they have not yet collected. And the same procedure takes place when it is a case of firemen's wages, or those of conductors or brakemen. If the other organizations, and those groups of employees farther down the scale, who are not so well organized, should bring their claims to arbitration, there is no valid reason why they should not also insist that they were responsible for the increased productive efficiency and that their specific contribution to the road's progress should be generously recognized.

But suppose that the claims of these various groups of benefactors are in excess of the earnings to be distributed. How are they to be satisfied? Very simply, respond the claimants. The public must contribute a larger sum in increased passenger and freight rates. Overlooking the absurdity of the proposition that surplus "productive efficiency" for distribution in wage increases can come from increased rates, we face the other difficulty laid down as the text of this discussion that the public is claiming its share of increased efficiency in a demand for lower rates. Give us our share of your increased efficiency through raising your rates, say the employees. Give us our share of your increased efficiency through lowering your rates, say the shippers. Is it any wonder that the railway executive asks for a joint commission of Congress to investigate his malady and prescribe a cure for his brain storm?

As a matter of fact, what we have here is a great railway system directed as a unit to the accomplishment of a specific end, for the realization of which hearty co-operation of every individual factor is necessary. It is a joint product and who shall say to whom the credit for its increased efficiency belongs? No fair-minded man, not an attorney for some interest, would venture to suggest any mathematical formula by which the fruits shall be distributed among those responsible for their growth. At best, the reasonable railway rate

and the reasonable wage must be determined by methods that are far from exact. As arguments for increased wages, cost of living, increased responsibility and risk, increased labor burdens, increased wages in other industries similarly situated, increased prosperity of the railways or, in other words, increased ability to pay, are all pertinent testimony and should be given the weight they demand by any judicial body seeking conscientiously to reach a fair conclusion. Nevertheless, their decision, after all the arguments and testimony have been weighed, must rest upon their judgment as to what under all the circumstances is reasonable and fair.

It is inconceivable that any intelligent body of arbitrators can be imposed upon by such a mathematical and economic absurdity as this demand of single groups of employees for a specific share in the benefits of productive efficiency, in the creation of which all capital and labor have been cooperatively engaged.

ECONOMICAL USE OF FREIGHT YARDS

ANYONE who aims at success in serving the public must adopt as one of the cardinal principles of his business the rule to give the public what it wants—even when people's wants are extreme. An enlightened public servant does this, even if he has a monopoly, as has been illustrated by the conduct of such concerns at the Pullman Company and the Westinghouse Air Brake Company. If there be sharp competition it is necessary to do all sorts of extravagant things. The grocer delivers very small quantities of goods and makes three deliveries a day to the smallest family; the department store, transporting hundreds of dollars' worth of goods to any point within a hundred miles, must leave them on approval, allowing a woman to keep three silk suits until they are almost out of style.

A recent illustration of this business principle occurs in the letter which the New York, New Haven & Hartford has sent to its freight patrons, wherein it appears that at the congested freight stations of that road throughout southern New England the company can deliver freight much faster than the consignees can take it away. It furnishes track room for a consignee to spend several days in unloading a car which could easily be emptied in one day, and so there is wasteful use of land and cars. For many years, on most railroads, it has been an obvious fact that the limit of the capacity of the railroad is fixed by its terminal facilities. Main tracks are improved or added to as needed, and engines and cars to use the tracks are not lacking. The term "car famine" is often a misnomer. But the provision of lands and tracks in cities is a complex problem, and the railroads in many cases have found themselves behind the times. They hauled the freight, but they could not conveniently put it into the owner's hands at destination. However, they have kept on trying, and though they have not succeeded in providing for all of the wants of the public in the busiest seasons, they have provided much more than they have got pay for. The New Haven's experience shows how, in this matter, the carriers have been giving the freight receiver more than, under true economy, he could reasonably ask for. They are like the merchant who, to accommodate unbusinesslike customers, keeps $200,000 worth of goods where $100,000 worth ought to answer; or ten delivery wagons where, with reasonable consumers, five would answer.

It is not clear how anything can immediately be done about it. The New Haven's appeal to the public contains no argument except that everybody ought to apply the Golden Rule. This, of course, is a very slow remedy, at best. If A or B hires extra men or wagons to hasten the unloading of his coal, lumber or grain, the immediate benefit inures to C, or D, or to the public in general; the benefit to himself is remote and intangible. And yet the economic argument for prompt unloading is sound and ought to be kept continually before the public. Cars have wheels, and are made to move; they are not storehouses. This axiomatic truth is not enforced with sufficient persistency. On the ideal team-track every car would be unloaded on the day of its arrival. The ideal lumber yard or private coal shed would have the capacity to take every incoming carload without any delay, even if the cars were to be bunched now and then. The receiver blames the carrier for its faults and lets it go at that; but such loose consideration helps no one.

The New Haven road appears to be able to deliver cars twice as fast as they are unloaded—perhaps we may say twice as fast as it is possible to unload them, with existing facilities. How accurate this ratio would be, as a basis for permanent calculations, and to what extent individual stations might show conditions worse or better than the average does not appear; but Mr. Clark of the Interstate Commerce Commission seems to confirm the general proposition. His declaration is equivalent to telling merchants and manufacturers that, for the best and most economical railroad service, they ought to provide freight facilities for themselves of twice the capacity now available. This statement may lack something in accuracy, but it embodies a fundamental economic truth of the first importance. The team track is not the end of the journey of a freight shipment; it is only a way station. The problems of promptness and celerity in moving the goods thence to the consignee's premises deserves just as careful consideration as that of speed on the railway track. To increase the speed of movements on the tracks merchants—or their friends in the legislatures—have in some cases taken the easy course of passing arbitrary laws designed to push the railroads; but to improve freight movement on their own section of the route they will have to do real constructive work. Or will they compel the railroads to buy more high-priced city land and to provide a still larger supply of wheeled storehouses?

ACCIDENTS AT GRADE CROSSINGS AND TO TRESPASSERS

THE number of persons killed at grade crossings and while trespassing on railway property in the United States is about 6,000 annually. This is 60 per cent of all the fatal accidents which occur on our railways. It is double the number of passengers and employees killed. It is, therefore, a terrible anomaly that far more public attention is given, and far more regulation is directed to reducing accidents to passengers and employees than to other classes of persons. Neither the public nor most public authorities seem to understand the true situation with respect to these matters, or, if they understand it, do not appear disposed to deal with it intelligently, fairly and effectively.

Here and there, however, there is a public official whose utterances show he has studied the statistics regarding and the causes of grade crossing and trespassing accidents,; that he has arrived at correct conclusions as to the only practical preventives of them; and that he has the courage to express himself frankly regarding them. A notable example is afforded by Alex. Gordon, a member of the Railroad Commission of California, whose recent address on accidents at grade crossings and to trespassers is published elsewhere in this issue. Mr. Gordon shows clearly that a large majority of grade crossing accidents are due to the needless multiplication of crossings of highways over railways, and to the carelessness of those using the crossings. The popular impression is that most grade crossings result from railways being opened across highways. As Mr. Gordon makes clear, the fact is that most of them are due to highways being opened across railways; and many of them are more of a menace than a convenience to the public. The remedy ordinarily suggested for grade crossing accidents is the

elimination of the crossings, at the expense of the railways. In view of the fact that most grade crossings result from highways being opened across railways, the adoption of this remedy is most unjust to the railways, unless they are allowed to pass the burden along to the public through their freight and passenger rates. In the long run, this is what is bound to occur. How impracticable, from the standpoint of both the railways and the public is the abolition of grade crossing accidents by the universal separation of grades, is indicated by some figures given by Mr. Gordon regarding the situation in California. There are 10,000 grade crossings in that state alone. Therefore, estimating the average cost of separating them at $30,000, the cost of eliminating all of them would be $300,000,000. But, as Mr. Gordon says, his estimate of $30,000 as the average cost of separating grades is very conservative. The average cost throughout the country up to the present time has been nearer $50,000. On this basis the total cost of separating all grades in California would be a half billion dollars; and California is but one state out of forty-eight!

The universal separation of grades as a remedy for crossing accidents is not practical because the cost of it would be prohibitive. There are other remedies the application of which would cost very much less, and which can be made effective. Mr. Gordon mentions a number of these. One point which his discussion brings out clearly, however, is that if this class of accidents is to be reduced there must be close, cordial and energetic cooperation between the railways and public officers. The railways should be required to adopt all reasonable measures to safeguard their crossings. If, after they have done this, their warning signals are disregarded, their watchmen are defied or their gates are broken down, as is now so often the case all over the United States, it becomes the obvious duty of the public authorities to step in and arrest and punish the offenders. Otherwise, all the efforts made by the railways will continue to be comparatively fruitless.

As to trespassing accidents, they present a problem which, as Mr. Gordon concedes, is far more one for public officers than for railway managements. It is often confused with the problem presented by grade crossing accidents; in fact, the two are entirely different. People have a right to use the highways to cross railway tracks. The need here is to so protect and police crossings as to prevent fatal and inexcusable carelessness and recklessness in the use of them. On the other hand, people have no moral or legal right to use the tracks of railways as highways or to steal rides on their trains. In view of the fact that more than one-half of all those killed on our railways meet their deaths while doing these things, it is a startling commentary on the motives that animate our lawmakers or the efficiency of our governments, that while it is possible to get passed and enforced laws to deal with almost every other real or imaginary cause of railway accidents, it is impossible to get either passed or enforced in most states laws to stop trespassing. The blood of all the more than 5,000 persons who are killed each year while trespassing on railway property cries aloud against the contemptible ignorance, indifference and incompetence of those responsible for the kind of government we have in this country; and thus far it has cried out in vain.

It is encouraging to find a member of a railroad commission discussing the conditions with the intelligence and candor shown by Mr. Gordon. It is to be wished that the members of all the commissions would not only speak out, but would use their influence to secure the passage and enforcement of proper laws. The "safety first" movement being conducted by the managements and employees of the railways needs to be supplemented by a "safety first" movement on the part of public officers free from political motives and dictated and directed by considerations of public welfare.

NEW BOOKS

Railway Statistics of the United States for the Year Ending June 30, 1915. By Slason Thompson, director of the Bureau of Railway News and Statistics, Chicago. 147 pages, 5½ in. by 8¼ in. Bound in paper. Published by the author at Chicago.

This is the twelfth edition of Mr. Thompson's annual volume of Railway Statistics. It gives the statistics for the essential features of railway construction, maintenance and operation compiled from copies of the official reports of the railroads to the Interstate Commerce Commission, and covers the operation of 448 companies operating 247,312 miles of line, an increase of 1,418 miles over that covered by reports of the preceding year. It therefore represents about 97 per cent of the mileage and about 98 per cent of the total traffic of the railways of the United States. It contains complete statistics by territorial groups, with comparisons going back, where possible, to the beginning of railway regulation, covering mileage, equipment, employees and compensation, capital, cost of construction, ownership, traffic, revenues and expenses, taxes, damages and injuries, accidents and other details of railway operation. The report also includes statistics for 22 foreign countries, from the latest official statistics available.

An especially interesting feature of the report at this time is a chapter devoted to employees and their compensation, for it gives the first published compilation under the new requirements of the commission regarding reports on the number of employees and their compensation. Under the new plan the employees are divided into 68 classes, and figures are given showing not only the average number employed throughout the year, instead of the number employed on June 30, but the total number of hours on duty during the year, the compensation per hour and the compensation per year.

Railway Expansion in Latin America. By Frederic M. Halsey, statistician, Jas. H. Oliphant & Co., New York. 170 pages, 41 illustrations, 4 maps, 5 in. by 8 in. Bound in cloth. Published by the Moody Magazine & Book Company, 35 Nassau street, New York. Price $1.50.

As compared with England and France, the United States has made but small investments in the railways of South America. Great Britain's investments in Latin American securities have totaled nearly five billion dollars, of which nearly three billion has been invested in Argentina, including one billion alone in the railways of that country. France, too, has made large investments in South America, particularly in Brazil. The fact that the United States is at present in an exceptionally favorable position to make investments in South America is the principal reason for the publication of this book, the material for which has been largely obtained from articles by the author which have previously appeared in Moody's Magazine.

The book gives in narrative form a history of the origin and development of all the railroad systems of the several South and Central American countries. It contains some very interesting details, the story of the Panama Railroad and that of the Northern Railway of Costa Rica being typical examples. The railway development in South America has been carried farthest in the region tributary to Buenos Ayres and least in the mountainous regions on the western side of the Andes. Over 40 per cent of the total railway mileage in South America is within the boundaries of Argentina. One of the reasons for the slower development on the Pacfiic slope is clearly shown in the fact that of the 16 railways in the world attaining the highest altitude, 10, including the first 8, are in western South America. The Peruvian Central attains the greatest height of 15,865 ft. at Morochoca, Peru, and of the 10 railways, four are in Peru, three in Bolivia, two in Chile, and one in Ecuador.

The book is well illustrated and contains a statistical appendix giving for different systems the rates, earnings, dividends and other data of the kind that for North American Railways is found in Poor's Manual.

Letters to the Editor

TRANSVERSE FISSURES

PITTSBURGH, Pa.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

On page 1175 of the *Railway Age Gazette* of June 2, Dr. J. S. Unger stated in his article on Rail Manufacture that "he has not heard of a case of a transverse fissure in a well supported rail, as on a bridge." I desire to call the attention of Dr. Unger and those who have read this statement to the investigation of transverse fissures or internal fissures in rails made by C. D. Young, engineer of tests of the Pennsylvania at Altoona, Pa., the results of which were published in bulletin No. 151 of the American Railway Engineering Association dated November, 1912. On pages 414 and 421 of this bulletin reference was made to transverse fissures found in rails laid on the Ohio Connecting Railway Bridge at Pittsburgh. This same information can also be found on the same pages in the Proceedings of this association for 1913, volume 14. The floor of this bridge was newly laid and in first class condition while the ties were spaced much closer together than is the case with track construction on the ground.

W. C. CUSHING,

Chief Engineer Maintenance of Way, South West System, Pennsylvania Lines.

THE STATE RAILWAY COMMISSIONS AND VALUATION

KALAMAZOO, Mich.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

I have read with interest the article by Pierce Butler in the *Railway Age Gazette* of March 17, and have been particularly impressed by what he says under the sub-heading,—"Is Cost the Equivalent of Value"? For instance the following extract:

> Eight or ten years ago there arose a demand for rate reductions, and many states . . . reduced both passenger and freight rates to levels below any that ever existed in this country, or elsewhere. . . . As a consequence, a large number of suits in equity were brought in behalf of the carriers to restrain the enforcement of many rates so prescribed on the ground that the same were confiscatory and amounted to a taking of property without due process of law. In these suits, or in some of them, it became apparent to the advocates of rate reductions that, if the cost of reproduction were to be given due weight in the ascertainment of value, such rates could not be sustained, and thereupon new theories for the valuation of railroad properties were promulgated.

If any evidence were necessary to establish the truth of this assertion, it might be found by a comparison of the attitude of the Railroad Commission of Minnesota in the years 1906 and 1912, respectively. It is well known that in 1906, the year that the Minnesota valuation was begun, the commission was firmly committed to the principle enunciated by Mr. Butler in the aforesaid article that the "Present value of the railroad, as measured by the cost of reproduction is the basis upon which profit should be computed." To this end a circular letter of instructions was issued to all of the carriers at that time, plainly setting forth this principle, and advising them to proceed upon the supposition that the territory traversed was identical in character with that at the time of making the valuation, with the sole exception that the railways were to be eliminated. Under such conditions the problem involved became that of ascertaining the cost of replacement of said railways.

In 1908 when the suits spoken of by Mr. Butler were in progress much data was compiled for this commission by the present writer, to show that the amount actually expended for right of way by some of the more recently built lines was from one and one-half to three times the actual market value of the adjoining lands. It is unnecessary to state that this data was of little use in justifying the rates which had been prescribed and was never used. The fact of its compilation is only mentioned to show that it was not until these suits were well under way that the commission experienced a change of heart in regard to the cost of reproduction theory.

Witness the attitude of this same commission in the latter part of 1912. At this time its engineer wrote an article entitled, "Reproduction Cost New as a Sole Basis for Rates" for the Journal of the Association of Engineering Societies, the sole purpose of which was to hold the aforesaid theory up to ridicule, and the commission in a prefatory note gave this article its unqualified endorsement, thus disowning in 1912 what it had openly advocated in 1906.

In the face of such tactics on the part of the politicians who constitute most of our state commissions, it is to be hoped that the time may come when the sole authority for the regulation of interstate carriers will be delegated to the Interstate Commerce Commission, and the bugbear of state regulation with which they must contend at present will be relegated to the scrap heap where it belongs.

L. S. POMEROY.

A LETTER FROM MR. FORMAN

SAN FRANCISCO, Cal.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

From a number of letters received since the publication of my first and second articles on the Revised Standard Code (*Railway Age Gazette,* January 14 and February 18), I find that there are a few points on which it is my duty to explain my meaning more in detail; and I must ask you for a little more space.

In pointing out what seem to me to be desirable changes in certain rules and regulations and showing why some rules are not, cannot and should not be enforced at all times throughout all parts of this country, my position is not enviable. At times I may appear to be inconsistent, as I must argue from many different points. It is to be expected often that the majority will oppose me or at least show a strong disinclination to depart from old customs, however unsatisfactory they may have been found to be. Having been in the service of many roads and having had an opportunity to discuss rules with many thousands of the rank and file, I have discovered that to print a rule does not mean that it will be respected.

Should the new code be adopted by all without any alterations whatever, adding such rules as may be desired, thus having universal diversity? Or should all unacceptable rules of the new code be eliminated or altered by each company and other needed rules be substituted or added? Or, thirdly, would it be better to have two official standards, naming them A and B, the late revision to stand intact and be known as code A; the rules to be decided upon hereafter to be known as code B, the latter to contain alterations, eliminations and such reasonable additions as would make it not only acceptable to those managers who feel that it is better to have clearance cards delivered with train orders, audible and visible stop and caution signals, restrictions as to the use of the 19 order, etc., but which will be enough of itself to enable it to be applied on many roads without material augmentation?

Instead of being an acrimonious and senseless attack, it is hoped that these articles will be looked upon as an impartial analysis of the code. Insofar as the code is sound and practicable, no writer is likely to convince anyone to the contrary. On the other hand, if there be some weak spots, the calling attention to them before its adoption by any road may result in much good.

My declaration in the first paper, to the effect that there was a way to make standard rules applicable everywhere,

and commending standards, was not made without rational reservation; for, to undertake to prescribe one inflexible set of rules to govern all roads would seem to border on the impossible.

There has been much discussion of Rules 11, 15, 208 and 214. Some managers might more readily approve rules somewhat like the following:

11. A train finding a fusee burning red on or near its track must stop. Unless otherwise instructed by the employee who made use of the fusee, extinguish it and then proceed for a reasonable distance with caution, prepared to stop short of train or obstruction.

A train finding a fusee burning yellow on or near its track must proceed for a reasonable distance with caution, prepared to stop short of train or obstruction. Yellow fusees should not be extinguished, except by the employee displaying them.

Good judgment is required in the use of fusees of the proper color. In throwing from a train, as far as practicable and consistent with safety, take into consideration the risk there may be in starting fire, causing explosions or unnecessarily stopping a train where it cannot be seen for a reasonable distance by any train which may be following it.

15. The explosion of one torpedo is a signal to stop. Unless otherwise instructed by the employee who made use of the torpedo, then proceed for a reasonable distance with caution, prepared to stop short of train or obstruction.

The explosion of two torpedoes not more than 200 feet apart is a signal to proceed for a reasonable distance with caution, prepared to stop short of train or obstruction.

During heavy rain or snow storms, and at other times when thought necessary, insure explosion of torpedoes by duplicating, that is, attach them to both rails, opposite each other.

While brevity is always desirable, a few extra words added to rules relating to matters as vital as cautioning or stopping trains, so that even common laborers cannot possibly misunderstand, is not a waste of words. The distance that an engineman should run with caution should correspond with the distance that men whose duty it is to warn trains must go out at that particular place. Except in isolated localities, I fail to see the necessity of dropping fusees between the rails, thus risking an explosion should cars loaded with inflammable freight, the contents of which may be leaking out, be stopped over a fusee. It is nearly always possible to drop them on the engineman's side; then there would be no need of delaying trains, or risking rear collisions, by requiring trains to stop to extinguish caution fusees. Nor will anyone contend that, even though a rule should so prescribe, trains will always be brought to a stop before passing fusees.

It is always "practicable" to include in the address of orders (Rule 208) the operator stationed at the place of meeting or waiting, if it be an open office. But where there are more non-communicating stations than open offices, or where on a division some 150 miles in length there are only a few offices open at night, as is frequently the case, it would appear that to omit this provision would be the safer course; this to prevent train employees from becoming careless in reading and keeping in mind their train orders, as has sometimes been found to be true where they have depended on the "middle order" as a check upon their memories.

At the present time at least one large system has thought best to so modify Rule 214 that a tie-up will not result should there be wire failure.

I am not yet ready to recommend the exclusive use of the 19 order, but could cite many cases where movements have been seriously retarded by requiring despatchers to give preference to Form 31. Both forms should be provided and a man who is thoroughly awake to the risk that there may sometimes be in issuing a 19 order should be charged with instructing despatchers as to when it is proper to use this form.

Instead of loading up the new code by adding many rules, those of no two roads being alike, thus again burdening trainmen with unending diversity, I now feel that it would be infinitely better to let such companies as may find the new code adapted to their needs make use of it without change; and permit such other roads as have valid reasons for insisting upon something different, possibly partly along the lines outlined in this series of papers, unite on another code, not necessarily greatly differing, but which shall contain provisions which would seem to be needed where existing conditions make somewhat different rules imperative, thus having two official standards. Should this recommendation be adopted, this would seem to solve the problem on nearly every road in the United States.

The fact that the new code does not arbitrarily prescribe any color to indicate proceed or caution partly illustrates the futility of attempting to harmonize all contending factions, or of ever hoping that all will march on to victory under the same banner. Hearty and universal approval and adoption of one standard code of rules without any alterations or omissions whatever may be looked for when one common standard engine, for a given class of work, has become a reality throughout the United States. H. W. FORMAN.

THE BROTHERHOODS AND TRAIN LENGTH LAWS

WASHINGTON, D. C.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

The *Railway Age Gazette* in a leading editorial in the issue of June 9, 1916, falls into the error of crediting to the representatives of the railroad employees the introduction by Representative Murray, of Oklahoma, of the bill to limit the length of trains to one-half mile. As a matter of fact, as National Legislative Representatives of the four transportation brotherhoods, we have had nothing whatever to do with the introduction in Congress of the Murray bill.

On September 26, 1914, during the second session of the 63rd Congress, Representative Murray introduced the bill (H. R. 18988) to limit the length of trains to one-half mile. In our report on national legislation covering that session, copy of which is being sent you under separate cover, we stated at page 50:

"It is understood that the Murray bill was introduced at the instance of one Fred L. Feick, a member of the Brotherhood of Railroad Trainmen; and his action was taken entirely without the knowledge or consent of the chief executives or the legislative representatives."

On November 20, 1915, the four chief executives and the national legislative representatives met in Washington for the purpose of considering what should be done during the first session of the 64th Congress in the matter of national legislation. The following is quoted from the circular which was sent to all legislative boards and lodges and divisions of the four organizations, showing the actions taken by the chief executives on the length-of-train bill:

"It was agreed unanimously that on account of the pending concerted movement regarding the eight-hour day, time and one-half for overtime, etc., by the four organizations, action on this matter should be held in abeyance until after the concerted effort has been made."

Believing that you will desire to correct the mistake that has been made in your publication, we submit these facts and you are at liberty to publish this communication.

H. E. WILLIS,
Assistant Grand Chief Engineer and National Legislative Representative, Brotherhood of Locomotive Engineers.

P. J. McNAMARA,
Vice-President and National Legislative Representative, Brotherhood of Locomotive Firemen and Engineers.

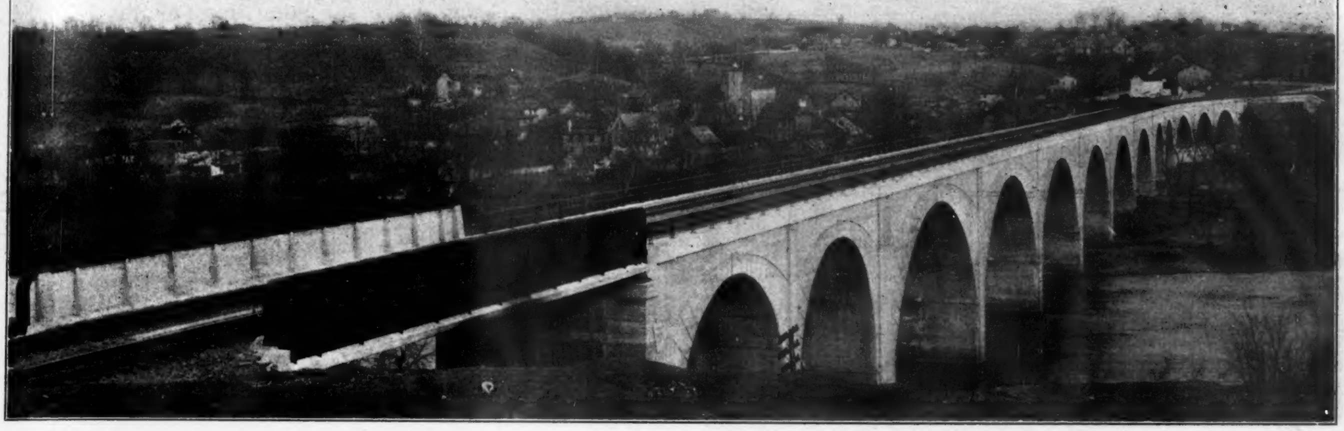
WILLIAM M. CLARK,
Vice-President and National Legislative Representative, Order of Railway Conductors.

VAL. FITZPATRICK,
Vice-President and National Legislative Representative, Brotherhood of Railroad Trainmen.

MANUFACTURING INK.—In place of the ink bottle the Illinois Central is using an ink tablet, which comes packed in a little vial and cost about 10 cents a dozen. There are 16 tablets to each vial and the 16 pellets will make one quart of first class ink. Instead of placing the tablets in a quart bottle and mixing the entire lot at one time, several of the tablets are placed in the ink well which is filled with water and stirred up and in a few seconds the water has been turned into ink.

Pennsylvania Railroad Bridge at Phoenixville

Description of an Arch Structure Recently Completed and of the Construction Plant Employed on This Work



View of the Completed Bridge.

THE Pennsylvania Railroad has recently completed an arch bridge over the Schuylkill river at Phoenixville, Pa., on the Schuylkill division to replace an old structure. In general, the design and the details of the new bridge follow the standard practice of the Pennsylvania for structures of this class, but local conditions necessitated the use of some interesting construction methods.

The old bridge, built in 1884, consisted (from west to east) of a 165-ft. through truss span over the Philadelphia & Reading tracks and the old Phoenix Iron Company canal, four 160-ft. deck truss spans over the Schuylkill river, four 90-ft. deck truss spans and one 50-ft. skew deck girder span. The substructure was built for double-track, as was also the through truss span at the west end, but all of the deck spans were for single-track only, and had been placed on the north ends of the piers with a view to permit the addition of the superstructure for second track on the south. Double-track having been installed on the line to the east and west of the bridge, gauntlet track was operated across the structure. The short deck truss spans and the skew deck girder span on the east end of the bridge were on a curve of six degrees. The rest of the bridge was on a tangent. Advantage was taken of this curve to place the new bridge on a new location south of the old one, with a maximum offset of about 38 ft. between the two lines. This permitted a large part of the construction work to proceed without any interference with traffic on the operated line.

The New Bridge

The new bridge consists of 15 arches and a half-through girder span, and provides for double track. The girder span is at the west end over the Reading tracks and provides a clear span of 76 ft. 3¾ in. East from this span in order, there are two 52-ft. semi-circular arches, six 90-ft. segmental arches, two 60-ft. semi-circular arches, one 80-ft. segmental arch, three 54-ft. segmental arches and one 34-ft. skew semi-circular arch. The five east arches are on a curve of 6 deg. The rest of the bridge is on a tangent.

The arches are of the filled spandrel type. The lines and proportions of the structure follow mass rather than reinforced concrete practice, although a certain amount of reinforcement is provided in the arch ring and the spandrel walls. The latter are divided longitudinally by vertical expansion joints behind the edges of each pilaster and also at intervals of 12 to 14 ft. between them. These joints are provided with vertical keyways, separation being insured by several layers of tar paper.

The through girder span is a double-track two-girder span with a floor consisting of 24-in. I-beams spanning transversely between girders. This floor is completely encased in concrete to afford smoke protection from the tracks below and also to provide for a ballast floor for the tracks above. Wooden boxes cast into the concrete between every two beams materially reduce the weight of the floor. The girder span complete weighs 300 tons. The entire bridge required 30,000 cu. yds. of concrete. All of the piers are on rock foundation, which, in the case of some of the shore piers, required excavation as much as 36 ft. below the ground level.

Construction Plan

Construction was commenced in May, 1914, and was continued, except for two months' interruption during the following winter, until its completion late in 1915. The change in alinement previously mentioned made it possible to build a large part of the structure without interference with the existing one, but owing to the fact that the single track deck trusses occupied only the north half of the old piers it was possible to cut away any parts of them that interfered with the new structure without disturbing traffic. The only serious interference was that involving the 165-ft. through truss span. The extrados of the two 52-ft. arches was low enough at the crown to clear the suspended floor beams of the truss span, but these floor beams interfered with the completion of the north parapet of the arches. In addition to this the pier supporting the east end of the truss span was in the way of the ring of the east arch, cnosequently the parapet was temporarily omitted and the east half of the old pier was cut down, except for a column of masonry supporting the southeast shoe, so that the east arch could be concreted complete, except for a hole which was left around the column of old masonry supporting the shoe.

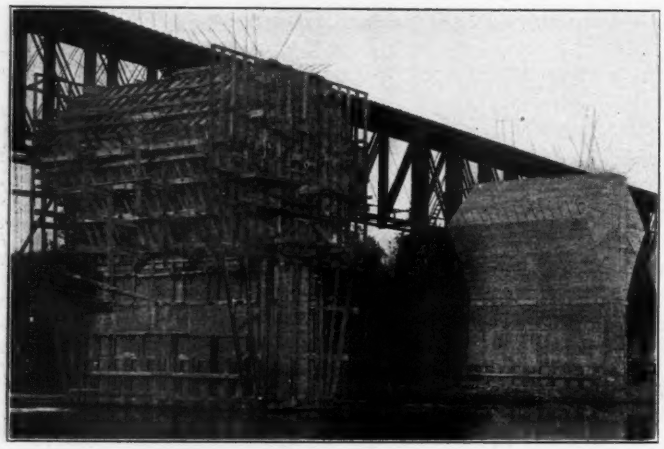
The girder span was erected far enough south to clear the old span; that is, partly on false work south of the bridge seats. Its position was such, however, that there was room to pass gauntlet tracks over the span approximately in the position of the final location of the eastbound tracks.

As soon as the other arch spans had been completed and were filled, double tracks were laid across them with gauntlet tracks over the through girder span in the position described above. The old spans were then dismantled and

when the through truss span was out of the way, the two 52-ft. arches were completed and the girder span was rolled into place on steel rollers between layers of rails.

Construction Methods

Two concrete plants were provided, one under the old through truss span and the other under the third old span



Piers for the 90-ft. Spans, Showing the Umbrella Form on the Pier in the Foreground

from the east end of the bridge. At each of these points sand and stone bins were built on trestles or timber cribs in positions that permitted them to be filled by dumping from cars standing on the bridge. Cement houses were also provided in a position that permitted spouting the sacks of cement. Concrete material was delivered from the bin to the mixer

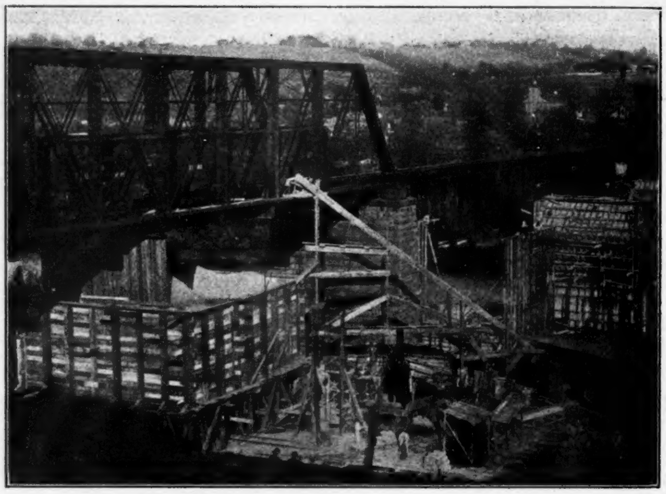
Steel Arch Centers in Position Showing the False Wooden Ribs Used to Obtain the Required Curve. Cable-Way Tower in the Distance

at the ground level and dumped into a charging elevator attached to the mixer.

The mixing plant under the through truss span furnished concrete for all of the arch spans from No. 1 to No. 9, inclusive, numbering from the west end of the bridge. This was accomplished by a bucket suspended from a cableway spanning between a tower on the west embankment and a tower projecting up through span No. 9 on the east side of the river. The other concrete plant was used for spans 10 to 15, inclusive. Here the concrete buckets were transferred on a narrow gage track laid alongside the bridge from which the buckets were lifted up to the forms by stiff-leg derricks.

The lower portions of the arches were cast with the piers before the arch centers proper were placed. Following the concreting of the piers to the springing line the umbrella-shaped portion between the springing line and the level at which the extrados leaves the pier was concreted. For the central portion of the arches ribbed centering was used, steel ribs for the 90-ft. arches and timber ribs for the other spans. The steel centers for the 90-ft. arches were some which had been used previously by the contractor, and the curve of their top chords varied materially from the contour of the 90-ft. arches for this bridge. A photograph shows how this difficulty was overcome by building false ribs of timber on top of the steel ribs to obtain the desired curve.

In the case of the wooden centers a set was made for each of the three 54-ft. spans. Two of these were modified for use for the two 60-ft. spans and later for use for the two 52-ft. spans. The other set of 54-ft. centers was used in the



Concrete Plant at the West End of the Bridge

34-ft. skew arch by placing them approximately parallel to the center line of the track and connecting them up by purlins on which plank joists were placed perpendicular to the center line of the arch, these joists being cut to give the desired curve.

The design and construction of this bridge was under the general direction of A. C. Shand, chief engineer of the Pennsylvania. It was designed under the immediate direction of H. R. Leonard, engineer of bridges and buildings, with H. S. Righter, assistant engineer, in direct charge of construction. L. H. Focht & Son, Reading, Pa., were the contractors for the entire structure.

The Argentine Railway Gage.—The first railway in operation in Argentine Republic, was a little six mile line extending from Buenos Ayres to a suburb known as Flores. This railway was chartered January, 1854, and opened to the public in 1857. Its owners, not being over supplied with funds, availed themselves of an opportunity to purchase a quantity of second-hand locomotives and cars which had been captured by the British during the siege of Sebastopol in the Crimea. This equipment had been built for an extremely broad gage, viz., 5 ft. 6 in. The Argentine Company laid its tracks to accommodate these cars and to this day the 5 ft. 6 in. gage is in general use throughout central and eastern Argentine.—*From Railway Expansion in Latin America, by Frederic M. Halsey.*

Accidents at Grade Crossings and to Trespassers*

Public and Public Authorities Largely to Blame for These Classes of Casualties. Remedies Suggested

By Alex Gordon

Member, Railroad Commission of California

WHILE the operation of trains in the United States has become safer, so far as passengers and trainmen are concerned, it has become much more hazardous to those who are compelled to cross the tracks. The reasons for this increase are not difficult to find. Before the coming of the automobile, traffic on the highways was carried on by horse-drawn vehicles at a speed which rarely exceeded ten miles per hour and which probably averaged less than five. On account of the limitations of the horse, drivers were generally in territory which was so familiar to them that they knew where each crossing was located, its condition and surroundings, and were often even familiar with the time tables of the railroads. In the country, because many horses were unused to trains, drivers as a rule desired to be as far away as possible from a crossing when a train passed over it. This has all been changed. The coming of the automobile has vastly increased the mileage of good roads, and the two together have made it possible for much traveling to be done in territory unfamiliar to the traveler, while the speed of traffic on the roads has been very greatly increased.

During this period in which the automobile has been developing, there has developed also a desire on the part of those who work in the cities to live in the suburbs, and this has led to the construction of interurban railroads and the use of high-speed cars upon them, as well as additional high-speed service on the steam railroads. Population in and about the larger cities has also greatly increased during this time and the traffic on both rail and road has been intensified by this growth.

The situation in California is peculiarly unfavorable to satisfactory grade crossing conditions. The state ranks third in the number of its automobiles. It will compare favorably with any state in the mileage of its improved roads. It has a large automobile tourist traffic unfamiliar with its highways, and it has a climate which permits the use of automobiles every day during the year. Its suburban trains, especially in the south, are numerous and run at high speeds, and the topography of the country in the valleys where the population is greatest, train service most frequent and improved highways most numerous, rarely permits of grade separations being made without the expenditure of large sums of money. In these valleys, also, fruit orchards are plentiful and grade crossings are often concealed by the trees at the intersection of the railroads and highways. Bearing this condition in mind, it is not difficult to believe that California, with less than 4 per cent of the population of the country and less than 2 per cent of the steam railway mileage, furnishes nearly 5 per cent of the deaths and injuries reported to the Interstate Commerce Commission as resulting from grade crossing accidents on steam railroads.

During the three years ended June 30, 1915, 249 people were killed and 1093 injured at grade crossings in this state. During the six months ended December 31, 1915, 65 people were killed and 222 were injured; in January there were 2 killed and 24 injured; in February 8 killed and 16 injured and in March 3 killed and 35 injured; and the record is always much worse in the summer than in the winter.

*A paper presented recently before the convention of the Boards of Supervisors of California.

MANY ACCIDENTS DUE TO CARELESSNESS

We are horrified at the waste of human life going on in Europe, but we hardly give a thought to the absolute waste of life which is going on around us unless we happen, in a measure, to be charged with responsibility for it. Crossing accidents result from a very small percentage of the movements which are made over railroad tracks on highways, but we are appalled when we collect these accident statistics and find how large the total is. The Interstate Commerce Commission, the state commissions all over the country, boards of supervisors, city officials, railroad officials themselves and others are carefully investigating the matter and attempting to work out some solution of this grade crossing problem.

An unfortunate feature of the situation is found in the fact that many of these accidents are due to carelessness. The Southern Pacific Company recently made test observations at 34 crossings. They observed over 17,000 motor vehicle drivers and found that 69½ per cent looked neither way before crossing the tracks, 2.7 per cent looked in one direction only, and but 27.8 per cent looked both ways. Nineteen and three-tenths per cent, or the incredible number of 3,300 drivers, ran over the crossings at a reckless rate of speed. Only 35 drivers, or two-tenths of one per cent, stopped their machines before crossing the tracks. Four thousand and nine hundred drivers of teams were observed, 39.4 per cent of whom looked in neither direction, 8.6 per cent looked one way only, and 52 per cent looked in both directions. Of 6,300 pedestrians observed, 49.1 per cent, or practically one-half of the total, looked neither way, 15 per cent looked in one direction only, and 35.9 per cent looked both up and down the track. The same company has tabulated the accidents on grade crossings which have happened during the last five and one-half years in an attempt to secure the reasons for these accidents:

	Killed Per cent	Injured Per cent
Ignored train and its warning	35.0	37.1
Ignored train and its warning, and warning of crossing bell, automatic and human flagman, and warnings of other persons	13.8	12.6
Ran into side of train	10.1	15.3
Stalled on track	7.8	4.2
Tried to beat train to crossing	16.0	9.3
Other causes	17.3	21.5
Total	100.0	100.0

This company during two years had 525 crossing gates broken by vehicles which drove into them while they were down.

In view of these figures the eventual solution of the crossing problem, it is plain, must be grade separation, but this solution is a long way in the future. There are over 10,000 grade crossings in California and $30,000 would be a low estimate of the cost of eliminating one crossing. To separate grades at all of the crossings would cost over $300,000,000, and it is, of course, out of the question to consider any such an expenditure at this time. Neither the people nor the railroads can stand it.

As long as the grade crossings must remain we must do what we can to make them as safe as possible.

There are three ways of protecting crossings. The most expensive is that of installing crossing gates with attendants.

It costs $700 to install a set of crossing gates, and $900 per year to pay the wages of attendants and the cost of operation. Probably the next best method of protecting crossings is by human flagmen. The railroads have found that it costs them about $600 per year to protect a crossing in this manner. The third type of crossing protection is by automatic bell, wigwag, automatic flagman or similar device, and while they are not as efficient as the other two types they are much better than no protection at all. These devices cost from $350 to $600 to install and the cost of maintaining them is from $2 to $10 per month. From this it can be seen that even the cheapest sort of protection cannot be installed at once at all the crossings in California—yet something must be done.

Under the provisions of the public utilities act of this state, which went into effect in March, 1912, the railroad commission has been made more or less responsible for grade crossing conditions in California. In Section 43-A of the act the legislature holds the commission responsible for the safety of future crossings by requiring that its permission shall be obtained before a new crossing can be constructed. In Section 43-B it rests the same responsibility upon it for crossings previously constructed by giving it the power to alter or abolish them or to require grade separations to be made in place of them. The commission fully realizes this responsibility and considers it one of the most important of the many duties it has to perform. It has had all crossing accidents resulting in loss of life investigated and as a result of these investigations many protective devices have been installed. It has repeatedly said in its decisions, and has followed the principle, that no more crossings shall be made unless they are absolutely necessary. Recently it has instituted a state-wide investigation into grade crossing conditions. In March the entire commission held hearings in San Diego, San Francisco, Sacramento, Fresno and Los Angeles to consider the subject and it now has several parties of engineers in various parts of the state engaged in making inspections and reports on grade crossings.

Excessive Increase of Crossings Over Railways

I would like to point out to you a few things you can do to assist the commission in the work it has undertaken—things which will have their influence in bettering the crossing situation in the state.

Most of the crossing applications upon which the commission acts, except spur track crossings, are made by cities, towns or counties to cross main line tracks of railroads. The railroad lines, and especially the main lines and the more important branch lines in California, are located and permanent. As the country settles up large, farming tracts are subdivided into smaller farms and property in and adjacent to the towns and cities is cut up into lots. It has been the experience of the commission that these subdivisions are laid out with but slight reference to the location of railroads within their boundaries, so far as grade crossings are concerned, and the streets and highways which traverse them are later accepted as public highways by the counties almost without question. When property in one holding is laid out on both sides of a railroad track, the streets or highways are located exactly as they would be if the railroad were non-existent, and although few streets are opened across the track when the project is first started, it is the expectation that later all of the various streets will be dedicated to public use and will cross the rails. If future subdivisions were laid out with the realization that all grade crossings will eventually be abolished, a large decrease in the number of grade crossings to be made would be effected.

This is a matter in which you can be of great assistance. The commission has, of course, no jurisdiction over the roads the counties accept as public highways, but if the county officials would refuse to accept road dedications which involve, or may, in the future, involve, the construction of crossings in close proximity to each other the number of crossings to be applied for would be lessened.

Another matter is that of closing railroad crossings which are not absolutely necessary. There are many instances in the state where public crossings have been built to serve one or two people who could be served almost as conveniently at some adjacent crossing. There are still other crossings which can be closed without causing inconvenience to anyone if short highways are built to some other crossing where the traffic can cross with more safety.

As was said in the commission's opinion in connection with an application of the city of Santa Cruz to construct a crossing: "It has been often argued that with a given amount of traffic across the track from one side to the other no additional hazard would be incurred by opening a few additional crossings. To show the fallacy of this argument it is necessary only to consider the case of a city where all the traffic crosses on one street and the same city with the track through it an open highway where vehicles and pedestrians can cross at will. In the first case, by having traffic concentrated at one point, the engine driver can and will use a certain amount of caution when crossing this street, and the users of the crossing will be induced to properly safeguard their own approach. Where the track is open, or where many crossings exist close together, it is impossible for an engine driver to take the same pains to avoid an accident, and the people who cross the track become careless and forgetful of the risk they incur and cross the track many times when it is not necessary to do so."

Here, again, is something which can very well be done by the boards of supervisors. I have said that every crossing carries with it a certain amount of hazard. It also carries with it the promise of future expenditures when all crossings are made at separated grades. When that time comes each crossing then in existence will mean an outlay of from $30,000 to $150,000 and the cost of that work will finally be borne by the people in higher rates even if the original cost is borne by the railroads. It is not only a good safety measure, but it is good business, to keep the number of new crossings down and eliminate now all crossings which are not absolutely needed.

I do not wish to convey the idea that the commission will oppose the construction of any more grade crossings. To develop the resources of the State good roads, conveniently located for public travel, are needed. We need more of them, and there are going to be grade crossings on some of them but we should remember that conditions are no longer what they used to be when automobiles were unknown and trains ran at speeds of 20 miles per hour, and we should not burden the counties and the railroads with public highway grade crossings by granting crossings, as we used to do, to accomodate everyone who takes the trouble to apply for them.

Remedies for Crossing Accidents

Meanwhile the existing situation must be met. It has been suggested that the legislature should pass laws requiring all motor vehicles to come to a full stop before passing over a grade crossing. In the opinion of many such a law would be unreasonable and because it was unreasonable would not be enforced. The city of Long Beach has an ordinance requiring all jitneys to stop before crossing a railroad track and it is reported to be very successful in its operation but this is a different matter from requiring all motor vehicles to stop at all railroad crossings in the state and the difficulties of enforcing it are much less than they would be in enforcing a similar law that was state-wide in its application. To my mind a better suggestion is a law requiring the drivers of motor vehicles to drive slowly when

approaching an intersection of a track and a highway. Such a law would not be unreasonable. The law abiding drivers —and I believe they form a large majority—would be careful to observe it and those who would not otherwise respect it would be compelled to respect it by the same officers that make them respect the speed limit law.

Personally I have not a great deal of sympathy with the careless driver who gets hurt in a crossing accident. But our figures show that when a driver is hurt or killed three or four people with him are also hurt and killed. Last September may be taken as a typical month. Three auto drivers were killed in the state that month and 10 other occupants of the automobiles were killed at the same time. Nine drivers were injured and 37 other occupants were injured. These other occupants of the vehicles struck by trains were in many cases—possibly in most cases—relatives of the drivers, often wives and children, and if the careless driver when left to himself so far forgets the safety of himself and those who are nearest to him as to jeopardize their lives in this fashion, it is time for the law to step in and tell him what he must do to guard them.

It has been suggested that some state body—the railroad commission, for instance—should have the right to place distinctive signs in a conspicuous location at all exceptionally dangerous crossings which would, under the law, require automobile drivers to bring their vehicles to a stop before crossing the track. Such a law, in connection with a law requiring slow speed over all crossings, might have a very helpful effect. The commission is now investigating the subject and will make such recommendations to the next legislature as the result of these investigations seems to make advisable.

The Great Evil of Railway Trespassing

Although the topic assigned to me was grade crossings I cannot resist the temptation to say a few words about a near relative of the grade crossing in causing death and injury; and that is trespassing on railroad right of way.

In 1914, 5,396 persons were killed in the United States and 6,176 were injured while trespassing on railroads, and these figures are about the same as those reported for previous years. During that same year there were 165 trespassers killed and 217 injured in California.

In the last 25 years there have been over 212,000 people killed in the United States in railroad accidents and of this vast number over 112,000 were trespassers. This record would be bad enough if those who suffered were tramps and "hobos," but when we find that 75,000 of the total killed while trespassing, were citizens of the locality in which the accident occurred and 13,000 were children under 18 years of age, we must all admit it to be absolutely disgraceful.

The grade crossing problem is one which is met with, more or less, in all countries, but trespass accidents occur only in the United States. In Europe the property of the railroads is no more used for public thoroughfares than are the privately owned ranches and farms in this country, and even Canada, with more excuse then the United States for permitting trespassing in and around railroad tracks, has rigid anti-trespassing laws which are strictly enforced.

What would we think of the manufacturing plants of this country if they permitted anyone who so desired, to wander at will around dangerous machinery and, as a result of this, killed and injured between 11,000 and 12,000 people every 365 days? We would tell their owners, very shortly, that they would have to keep those people out and if they could not do it we would see to it that the police did. Yet the case is exactly parallel with railroad trespassing. The railroad companies are anxious to have strong anti-trespass laws and in the few states in the east where there are such laws, they do their best to enforce them. But they cannot keep people from their property unless laws have been passed and unless, when passed, they are enforced.

During the year ended June 30, 1914, there were, as I have said 165 people killed and 217 injured in trespassing accidents in California, while during the same period there were 93 killed and 378 injured in grade crossing accidents. It would cost over $300,000,000 to eliminate the grade crossing accidents by separating grades, but the cost of eliminating the trespassing accidents would be confined to a small extra cost of policing after the necessary laws had been passed.

It is sometimes so convenient to use the railroad track as a footpath, and we have grown so accustomed to considering ourselves entitled to walk on the track to save ourselves a little longer walk by road or street, that I am not very hopeful that I shall live to see the day when legislatures will pass and the people themselves will enforce, laws which will do away with this evil. But I believe the day will come when it will be done and those of us who are compelled to think of these things should do all we can to hasten its coming.

A LETTER FROM FRANK TRUMBULL

The following letter appeared in some of the New York papers of recent date, signed by Frank Trumbull, chairman of the board of directors of the Chesapeake & Ohio:

May I call attention to an editorial in the New York American, of May 26, entitled "Shortest Road to Honest Government Is by Way of Public Ownership," in the hope of correcting some wrong impressions that might be gathered therefrom?

From the tenor of this editorial it is impossible not to conclude that government ownership and operation of railroads in Canada is a pronounced success. Since this is not true, it seems fitting that the facts about this situation should be stated.

The Canadian Government has operated the Intercolonial for forty-seven years and the Prince Edward Island Railway for forty-three years. It has built and is now operating the National Transcontinental. The aggregate mileage of these Government roads is 3,800. Not one of these systems earned its operating expenses for the fiscal year ended June 30, 1915. The combined operating deficit of the three was $350,000.

For twenty-five years of the forty-seven aforementioned, the expenses of the Intercolonial exceeded its earnings, the aggregate operating deficit being $11,500,000. For twenty-two years its earnings were greater than its expenses, the gain being $1,967,000. The net deficit from operation for the whole period of forty-seven years is, therefore, $9,500,000.

During every one of the forty-three years of its operation by the Government, the Prince Edward Island's operating expenses exceeded its earnings, resulting in a total operating deficit of $3,280,000. Together with the net loss on the Intercolonial, aforementioned, the deficit of the two Government roads is $12,800,000.

In 1914 both roads lost $445,000, the joint difference between operating expenses and earnings; and, as previously stated, these roads showed expenses heavier than earnings for the fiscal year 1915.

With such losses confronting the taxpayers of Canada, it is pertinent to mention that these government railroads do not pay taxes. Last year Canada's privately-owned railroads paid the public in taxes $3,049,728.

Apropos of "honesty" under Government railroad ownership and operation, the building of Canada's latest acquisition, the National Transcontinental Railway, has led to a scandal. The cost of this road was estimated originally at $34,083 a mile; it has actually cost $99,000 a mile!

In 1914 a Government commission on this operation said that there had been gross mismanagement, extravagance, and

waste in connection therewith running into many millions of dollars, and the Grand Trunk Pacific, because of the enormous expense of this line, declined to lease and operate it at a rental of 3 per cent of its cost.

Work on the National Transcontinental was directed and supervised by four Government commissioners. The commission subsequently appointed to investigate the whole transaction reported that "$40,000,000 was needlessly wasted"; and that the cost of the National Transcontinental, for principal and interest up to 1921, will amount to $234,651,252.

Speaking of the work of the Government's commissioners who directed the road's construction, this investigating commission says:

"Having decided upon a design, the commission proceeded to find a country to fit the design. It may seem incredible, but it is the fact that it was assumed that the road would at once receive the maximum business it was possible to earn with a single track. That there was an entire lack of business along the line does not seem to have occurred to them . . . and in our opinion the interest payable to the Government and the operating expenses taken together will be about the same as the dividends, interest charges, and operating expenses of the competing roads (privately owned railroads), *which are only capitalized at from one-third to one-half as much per mile* as is the National Transcontinental."

Continuing, the report says that contracts were not let to the lowest bidders; that contractors were overpaid $3,300,000 on improper classifications; that certain contractors were paid two prices for one handling of material; that the chairman of the commission paid one man $7,950, on a pretended damage claim, for election activity; that money was spent improperly on unnecessary fences, on unsuitable rails, on the building of unauthorized shops and of double track, in violation of the statute which called for single track.

The report further condemned the premature construction of the New Brunswick section of the railway, pointing out that if one-third of that cost had been expended on the Intercolonial, all the trunk-line facilities necessary for the Province of New Brunswick for many years would have been provided.

It may interest your readers to know that the Montreal Gazette once commented upon these roads thus:

"There are not in North America anything like the records the government made last year in connection with the Intercolonial and Prince Edward Island Railways. These records were made, too, after the properties had been for eight years under control of the present Ministers, and after tens of millions had been spent in improving and strengthening the roads for carrying traffic at a loss. It does not seem that incompetence alone, even of the worst kind, can account for such a shameful and threateningly ruinous state of affairs."

In view of these established and indisputable records, "the people, in their organized capacity, through their Government" (to quote the American's own words), do not seem to have surpassed, nor, indeed, to have equalled, "the haphazard, disorganized" effort of the individual railroad owner in Canada, whose lines are operated at a profit. Furthermore, these records do not warrant the American's conclusion: "The shortest road to honest government is by way of public ownership of the public-service corporations."

A major cause of the poor showing made by the Intercolonial has been the influence of politics. The part which politics formerly played is freely admitted by the officers of the road, although they say that conditions are somewhat different now. "Almost every abuse known to railroading," says the Canadian newspaper aforementioned, "took root and flourished, such as under-billing—that is, permitting a favored shipper to load the cars with a larger quantity of goods than he paid for, while his competitors on the other side of politics were restricted to a standard load, and mulcted for any excess; the granting of secret rebates; the maintenance of an excessive number of stations and employees in order to swell the political influences of the road at election times; absurd classifications; unjust tariffs; the acquisition of more or less useless branch lines to serve partisan ends, and so on.

Statistics relative to public ownership of railroads in Australia and New Zealand, of which the American made passing mention, prove that the system is similarly unprofitable and unserviceable. And, indeed, this result must ever follow under a system which capitalizes all its errors and omits the strongest incentive to improvement—the hazard of the private builder, who knows that in error lies loss and probable bankruptcy, and who, accordingly, strives for economy, efficiency and real service.

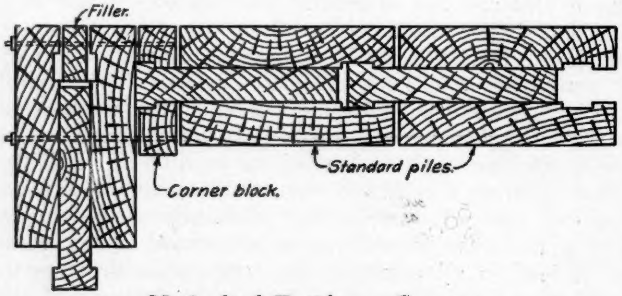
"While private individuals perform a public function, they will constantly resist public regulation," said the American. Surely it could not mean this for the railroads of this country. Regulated by Congress and one Federal commission, and by forty-eight State Legislatures and their respective State railroad commissions, our carriers, today, are over-regulated, if not strangulated, by an uncoordinated, conflicting, illogical and unbusinesslike system of supervision. It is not regulation, but forty-nine masters, that are proving too much for the railroads, whose strength, after all, is limited.

Far from resisting regulation, all the railroads of the country are in favor of regulation; but they ask that regulation be sane and consistent. The inquiry proposed by the Newlands resolution, now before Congress, would give every citizen an opportunity to be heard on this vital question, and, perhaps, lead to a sensible, consistent policy of railroad supervision.

FRANK TRUMBULL.

A NEW TIMBER SHEET PILE

The accompanying drawing shows a modification of the well-known Wakefield sheet pile which has been devised to provide a positive interlock, like a steel sheet pile. The outside members of each unit are grooved on the inside of the mortise to receive lugs of a corresponding shape on the sides of the tenon of the middle piece. Sufficient clearance is provided to prevent binding, but the fit is close enough



Method of Turning a Corner

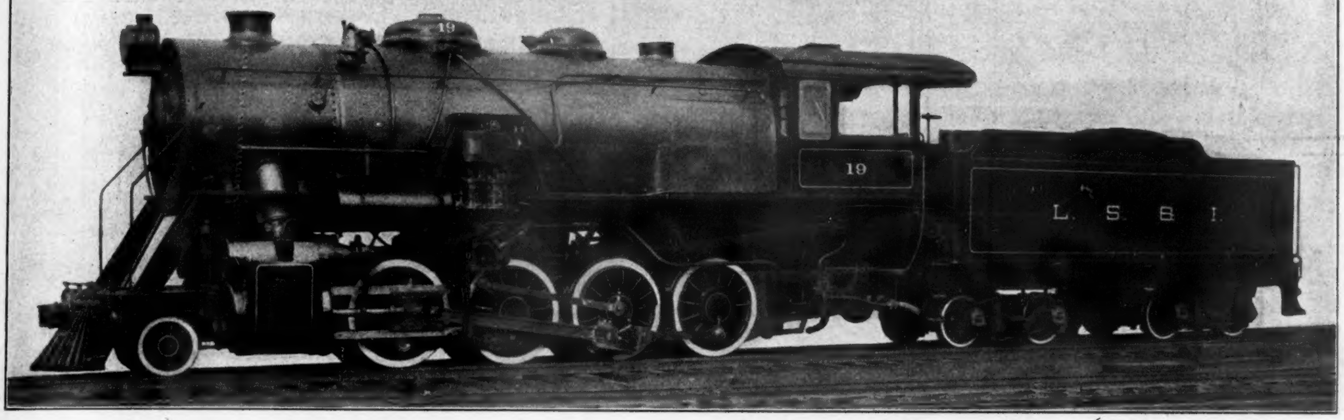
to insure a water-tight cofferdam. The units can be made up in lumber of any thickness within reasonable limits, and ordinarily have a total net thickness of from 4½ to 6 in.

This sheet piling has been used extensively for some time, particularly in the south. One installation comprised 250 lineal feet for the Louisiana Railway & Navigation Company, with piles 4½ in. thick and 24 ft. long, driven to a penetration of 16 ft. These piles are manufactured from long leaf yellow pine under the name Martinez Interlock Wood Sheet Piling, by the J. J. Newman Lumber Company, Hattiesburg, Miss.

BRITISH RAILS ABROAD.—The exports of rails from the United Kingdom continue to show a great reduction, only amounting in March to 3,368 tons, as compared with 17,572 tons in March, 1915, and 40,207 tons in March, 1914.

Large Locomotives of the Consolidation Type

Engines for Ore Traffic on Lake Superior & Ishpeming Weigh 268,000 lb., Develop 55,900 lb. Tractive Effort



Consolidation Type Locomotive for the Lake Superior & Ishpeming.

THREE large Consolidation type locomotives, developing a tractive effort of 55,900 lb., have recently been built for the Lake Superior & Ishpeming by the Baldwin Locomotive Works. These locomotives will be used for ore traffic, their most exacting service being to haul trains of

Cross Sections of the Boiler

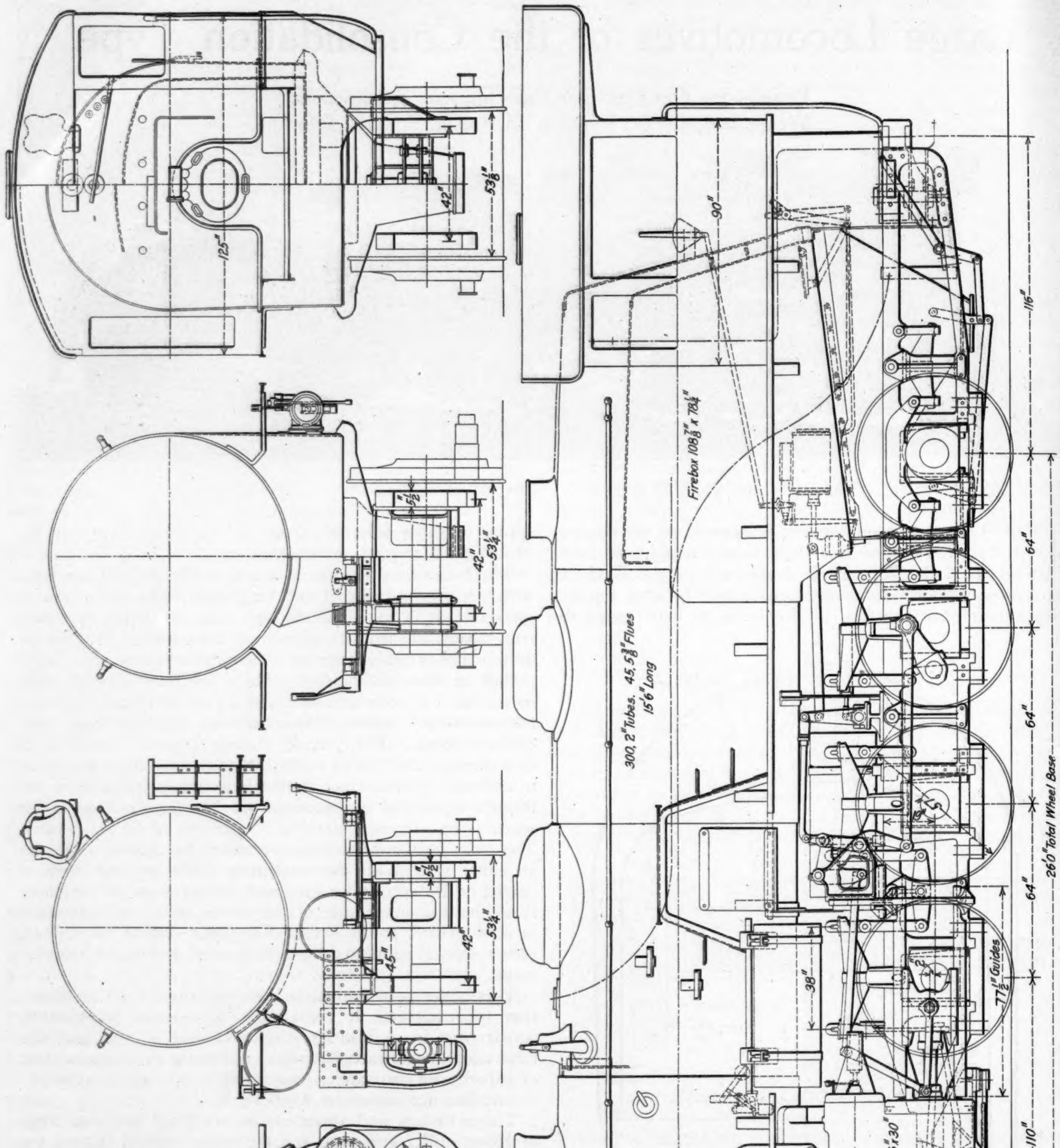
empty steel cars up a grade of 1.63 per cent, combined with curves of 5 deg. The question as to whether Consolidation or Mikado type locomotives should be built for this service was carefully considered and it was decided that, as the run is made at comparatively slow speed, the Consolidation type would be fully capable of meeting the requirements. Furthermore, the Consolidation could be designed with a total wheel base of the engine and tender to suit the turntables, which have a length of 65 ft. A fourth locomotive, similar in all respects to those referred to above, has been built for the Munising, Marquette & Southeastern.

The boiler used in this design is of the straight top type, with sloping roof, throat and backhead. The center line is placed 10 ft. 4 in. above the rail, and by sloping the mud ring toward the front there is room for a throat 19 9/16 in. deep. The furnace contains a Security sectional arch, supported on four water tubes. The dome is of pressed steel, measuring 33 in. in diameter and 12 in. in height. It contains a throttle valve of the improved Rushton type, with drifting valve. The vertical throttle pipe is flattened in cross-section, and placed sufficiently far forward in the dome to enable a man to enter the boiler without dismantling the throttle valve and its connections. The longitudinal boiler seams have a strength equal to 90 per cent of the solid plate. The seam on the dome ring is welded throughout its length on either side of the dome opening. The injector check is placed on the top center line, and the seam on the first ring is welded on either side of the check hole, and this seam is also welded at the ends. The front end of the firebox crown sheet is supported by three rows of Baldwin expansion stays.

This boiler is of unusually high capacity for a Consolidation type engine. It contains a 45-element superheater, which provides a heating surface of 844 sq. ft., and the total equivalent heating surface, assuming each square foot of superheating surface as equivalent to 1½ sq. ft. of evaporative heating surface, is 4,909 sq. ft.

The cylinders and steam chests are lined with bushings of Hunt-Spiller gun iron, and the same material is used for the piston and valve packing rings. The Nathan automatic vacuum breaker is applied. The valve motion is of the Baker type, and the gears are controlled by the Ragonnet power reverse mechanism which in this case can be operated by either air or steam. The valve motion bearers are supported on the guide yoke. The crosshead link is attached directly to the crosshead wrist pin, thus saving weight and simplifying the design.

Each main frame is cast in one piece with a single front rail, and has a width throughout of 5½ in. The transverse frame braces include a large steel casting which supports the front end of the firebox, and is extended forward to brace the main driving pedestals. The brake cylinders are supported on the main frames, just forward of the leading driving pedestals. The brake shaft is fulcrumed on two steel



General Arrangement of the Lake Superior & Ishpeming Consolidation Type Locomotive

castings which are bolted to the frames under the cylinder saddle. These castings also serve to support the engine truck radius-bar crosstie.

The tender frame longitudinal sills consist of 13-in. steel channels. The tank is of the water bottom type, with a capacity for 8,500 U. S. gal. of water and 13 tons of coal.

These locomotives rank among the largest of the Consolidation type thus far constructed, and probably represent the maximum capacity obtainable in this type with the weight and clearance limitations imposed.

The following are the principal dimensions and data:

General Data

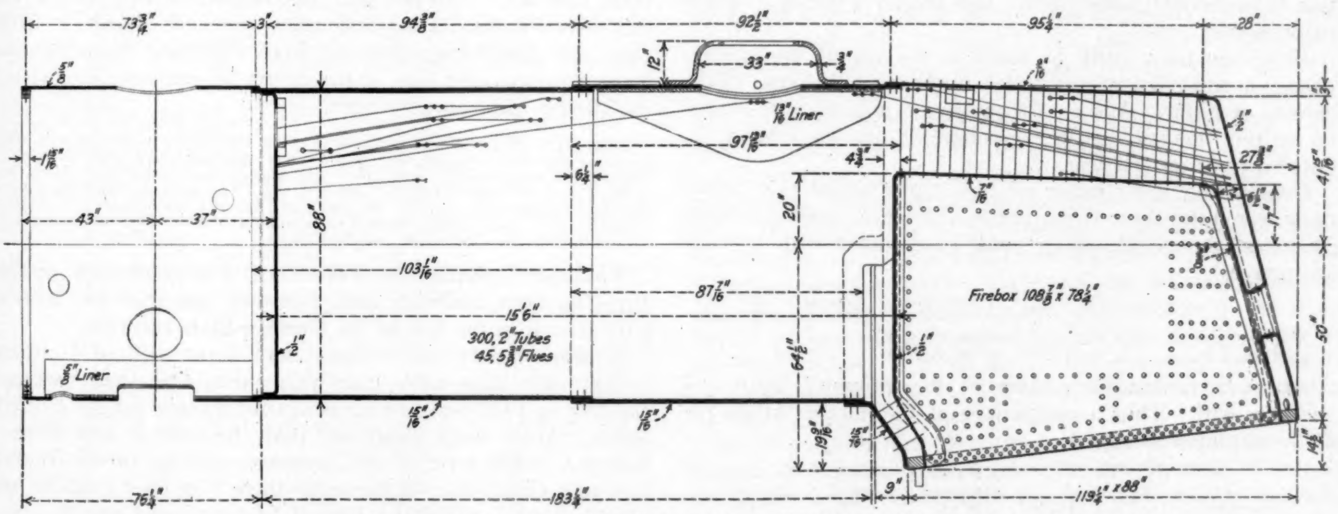
Gage	4 ft. 8½ in.
Service	Freight
Fuel	Bit. coal
Tractive effort	56,500 lb.
Weight in working order	268,000 lb.
Weight on drivers	238,000 lb.
Weight on leading truck	30,000 lb.
Weight of engine and tender in working order	425,000 lb.
Wheel base, driving	16 ft. 0 in.
Wheel base, total	26 ft. 0 in.
Wheel base, engine and tender	60 ft. 11½ in.

Ratios

Weight on drivers ÷ tractive effort	4.21
Total weight ÷ tractive effort	4.74
Tractive effort × diam. drivers ÷ equivalent heating surface*	658.00
Equivalent heating surface* ÷ grate area	85.20
Firebox heating surface ÷ equivalent heating surface,* per cent	4.40
Weight on drivers ÷ equivalent heating surface*	48.40
Total weight ÷ equivalent heating surface*	54.60
Volume both cylinders	18.50 cu. ft.
Equivalent heating surface* ÷ vol. cylinders	265.00
Grate area ÷ vol. cylinders	3.43

Cylinders

Kind	Simple
Diameter and stroke	26 in. by 30 in.



Boiler of the Lake Superior & Ishpeming Consolidation

Valves

Kind	Piston
Diameter	14 in.

Wheels

Driving, diameter over tires	57 in.
Driving, thickness of tires	3½ in.
Driving journals, main, diameter and length	11 in. by 13 in.
Engine truck wheels, diameter	30 in.
Engine truck, journals	6½ in. by 12 in.

Boiler

Style	Straight
Working pressure	185 lb. per sq. in.
Outside diameter of first ring	88 in.
Firebox, length and width	108⅞ in. by 78¼ in.
Firebox plates, thickness, sides and back, ⅜ in.; crown, 7/16 in.; tube, ½ in.	
Firebox, water space	Front, 5 in.; sides and back, 4½ in.
Tubes, number and outside diameter	300—2 in.
Flues, number and outside diameter	45—5⅜ in.
Tubes and flues, length	15 ft. 6 in.
Heating surface, tubes and flues	3,398 sq. ft.
Heating surface, firebox	216 sq. ft.
Heating surface, arch tubes	29 sq. ft.
Heating surface, total	3,643 sq. ft.
Superheater heating surface	844 sq. ft.
Equivalent heating surface*	4,909 sq. ft.
Grate area	57.7 sq. ft.

Tender

Weight	157,000 lb.
Wheels, diameter	33 in.
Journals, diameter and length	6 in. by 11 in.
Water capacity	8,500 gal.
Coal capacity	13 tons

*Equivalent heating surface = total evaporative heating surface + 1.5 times the superheating surface.

WHERE GERMAN EFFICIENCY FALLS DOWN*

By H. W. Faus

Asso. Mem. Can. Soc. C. E.

At this time, when all the world is impressed by the wonderful efficiency of the German military and industrial systems, it is well to remember that in one line of industry—the management of their railroads—the Germans have much to learn from the United States.

It is true that considering only *government owned* railways, those of Germany unquestionably rank above all others, but they make a poor showing when compared with our own privately-owned roads. Some government ownership enthusiasts would have us believe that this is not true, but no matter how much or how loudly they may talk they can't get around these facts: American railroads, taken as a whole (1) pay twice as high wages, (2) furnish better service (3) at lower rates than the German railways, or any state-owned railways in the world.

Wages.—First, consider the question of wages. The average daily pay of German and American railway employees during 1910 (the latest year for which the German figures are available) was as follows:

Germany	$0.81 per day
United States	2.23 per day

These figures, however, are not quite fair to Germany, because in addition to regular wages, certain German employees receive supplementary allowances in the form of house rent, uniform allowance, bonuses, etc. For this reason the average annual earnings per employee reflect more clearly the true situation thus:

Average Annual Earnings per Employee, Including Allowances and Bonuses

		Number employees	Total compensation	Average per employee
Germany	(1912)	743,944	$300,723,513	$404
United States	(1914)	1,698,818	1,373,069,811	808

That is, the privately-owned American railroads pay just twice the average wages that the German government pays. It is true that $404 will buy more food, clothing, and many other things in Germany than the same amount would buy in the United States; but *it will not buy more transportation in Germany.* In fact it will not buy nearly as much, as will presently be shown by a comparison of the passenger and freight rates in the two countries.

*The facts and figures quoted in this paper are taken from "Statistiks der im Betriebe befindlichen Eisenbahnen Deutschlands" (official statistics of railways of Germany), "Archiv fur Eisenbahnwesen," reports of the U. S. Bureau of Labor and Interstate Commerce Commission, the "Railway Library," 1914, by Slason Thompson, and from evidence submitted in the Western Interstate Passenger rate case (1915).

Not only are German employees poorly paid, but they are subject to much more severe discipline than American railway employees would ever submit to for any wage. Infraction of rules is punished not only by reprimand, suspension, fine, or dismissal, but in many cases by imprisonment. "In 1910 there were 132 cases of criminal prosecution [in Prussia alone] and 81 employees were given court sentences."* Membership in labor unions is forbidden to all employees.

Quality of Service—Safety.—In the matter of safety the German railways make a better showing than our own do—until the figures are analyzed. The following is a comparison of the total number of passengers, trainmen and trespassers killed in one year as disclosed by the latest official reports:

	Passengers	Trainmen	Trespassers
Germany ....(1912)	131	682	326
United States ....(1914)	223	1,477	5,471

If allowance be made for the fact that the United States figures represent a mileage of 245,894 as against 37,665 for Germany the situation appears in a new light.

Number Killed in 1 Year per 10,000 Miles of Line

	Passengers	Trainmen	Trespassers
Germany ....(1912)	35	181	87
United States ....(1914)	9	60	222

Thus we see that German railways kill per mile of line about four times as many passengers, three times as many employees, but only about two-fifths as many trespassers. American railroads can do very little towards decreasing the fatalities to trespassers until they can secure more co-operation from the civil authorities. It is largely a question of law enforcement.

Exception may justly be taken to the use of the mileage basis for these comparisons, for it takes no account of the density of traffic. And yet the mileage is a factor that cannot be entirely ignored, for in every mile of line there lurks the possibility of an accident.

Considering the number of passengers killed per billion passenger miles there is very little difference between the two countries, though Germany must be credited with a small advantage.

	Passenger miles	Passengers killed per billion passenger miles
Germany ....(1912)	24,746,513,960	5.3
United States ....(1914)	35,129,269,000	6.3

American railroads are safer for the trainmen, figure any way you will. Thus a comparison of the number killed per 1,000 employed shows:

	No. trainmen employed	Number killed	No. killed per 1,000
Germany ....(1912)	136,142	682	5.0
United States ....(1914)	311,131	1,477	4.7

The above averages for both passengers and trainmen gain additional significance when it is remembered that a large part of the mileage of the United States is scattered over thinly populated areas, with consequently small earnings, and that the maintenance of the highest class roadbed and equipment and the installation of costly safety devices on these lines is often an impossibility.

If we compare the German railways with those railways which serve the more thickly populated parts of the United States we find the comparison, from a safety standpoint, is anything but flattering to the Germans. In fact, out of 443 railroads reporting to the Interstate Commerce Commission, 315 of them killed no passengers in train accidents during 1914. For example, the New York Central, operating a mileage equal to one-third that of Germany, has not killed a single passenger on the "Line East" for more than five years; and, prior to the recent wreck at Amherst, Ohio, the "Line West" had a record of three years without a passenger fatality. And yet these 315 railroads operate a mileage equal to over three times that of all the railways of Germany.

*W. J. Cunningham, Asst. Professor of Transportation, Harvard University, in a paper read before the New York Railroad Club, April 18, 1913.

Speed.—It is quite commonly believed in this country that the German trains exceed ours in speed. The reverse, however, is true. The fastest train in Germany before the war was the famous "D-Zug-20," which ran from Berlin to Hamburg, 178.2 miles, in 3 hours 14 minutes, an average speed of 55.1 miles per hour. The Philadelphia & Reading Railway operates no less than 9 trains between Camden and Atlantic City, 55.5 miles, at an average speed of over 60 miles an hour. The Pennsylvania also operates several short distance trains at mile-a-minute speed.

When it comes to long distance runs, the fastest train in the world is the New York Central's "Twentieth Century Limited," running between New York and Chicago, 979 miles in 20 hours, an average of 48.9 miles per hour. Almost equally fast is the "Southwestern Limited" operated by the same company between New York and St. Louis, 1,245 miles at an average speed of 47.9 miles an hour. The nearest approach to these records in Germany is (or was) made by the international "through train de luxe" from Vienna through Munich and Strassburg to Paris, 860 miles at an average speed of 39.5 miles an hour.

Equipment (Passenger).—Sixty-eight per cent of the passenger cars on the Prussian State railways have side entrances and no vestibules or toilet facilities. Only 86 per cent. are equipped with air brakes.

Considering the fact that the rates of fare (in proportion to wages) are so high in Germany that in 1910 only .16 of 1 per cent of all passengers were able to afford to travel first class and only 8.02 per cent second class, while 41.16 per cent traveled third class and 50.66 per cent fourth or fifth class, the following quotation from Professor Cunningham gives a pretty good idea of the degree of comfort enjoyed by the average German passenger:

> First class compartments correspond with our parlor cars; second class are as comfortable as our best modern day coaches; third class accommodations are considerably worse than our poorest and oldest day coach, or perhaps a shade better than our colonist car. The seats in third class cars are not upholstered. . . . We have nothing that compares with fourth class. . . . As a rule those who stand in fourth class compartments far outnumber the fortunate few with seats.

Professor Cunningham was referring to conditions on the Prussian State railways only, but they comprise the largest part as well as the best of the German State railways.

Equipment (Freight).—Less than 3 per cent of German freight cars have more than two axles, and their average capacity in 1911 was 14 tons as against 37 tons for the United States. Much more significant than the average size of car, however, is the ratio of total tonnage capacity of all freight cars to population. In Germany there is a total capacity of only 1/7 ton and in the United States almost one ton per capita. This certainly indicates that the American public is the more generously supplied with freight facilities.

Small wonder, then, that in 1911 and 1912 there was a shortage of cars in Germany such as has never been known in this country, resulting in the closing of many mines and the suspension of manufacturing works. Shortage of equipment also accounts for the rule allowing shippers only 12 hours for loading and unloading cars. In times of car shortage, which are frequent, this allowance is reduced to 6 hours. American railroads allow two days.

In 1911 only 34.6 per cent of all German freight and baggage cars had brakes of any description, and only a few of these had air brakes. Automatic couplers have not yet been adopted, although they have been tried experimentally. Practically 100 per cent of all American cars are fitted with both air brakes and automatic couplers.

Broadly speaking, the type of equipment in general use on German railways today went out of style in this country several decades ago—along with the tallow candle and the hoop skirt.

Rates—Passenger.—Whenever a government ownership enthusiast plunges into an argument for the purpose of show-

ing how the public might profit by the adoption of his ideas there is just one straw for him to seize for support. It is this fact: The average receipts per passenger mile in Germany are only about one-half as much as in the United States. For 1912 the figures were .91 cents for Germany and 1.98 cents for the United States. It appears, therefore, that German rates are lower than American rates.

The joker in this argument is the fact that practically all passengers in America travel first class, while we have seen that over 90 per cent of German passengers ride third or fourth class—the 50 per cent who ride fourth class being compelled to put up with accommodations that Americans would not tolerate at any price.

In making a comparison, therefore, it is only fair that we compare rates for similar classes of service. Certainly no injustice will be done the German railways if we consider their first class on a par with our Pullman parlor car service, and their second class as equal to our first class. If anyone thinks the following examples are not typical let him refer to the Congressional Record of June 8, 1906, and note the list of 130 comparisons there given between passenger fares in Europe and the United States, for all distances from 50 up to 1,900 miles. The figures here given are more recent than those in the Congressional Record, but they do not differ materially, except that these include baggage charges while those do not.

COMPARISON OF GERMAN FIRST CLASS RATES WITH AMERICAN FIRST CLASS PLUS PARLOR CAR FARES

(Through Express Trains)

	Berlin to Hamburg	New York to Baltimore	Berlin Eisenach-Frankfort	New York to Lyons, N.Y.
Distance (miles)	178	187	331	335
Railway fare	$5.88	$4.65	$10.33	$6.96
Baggage charge (150 lb.)	.95	Free	1.43	Free
Parlor car seat	....	1.00	....	1.75
Total charge (day)	6.83	5.65	11.76	8.71
		Lower berth		Lower berth
Sleeping car	1.90	$2.00	2.38	$2.00
Total charge (night)	8.73	7.65	14.14	8.96
Rate per mile (day.)	3.84 cts.	3.02 cts.	3.55 cts.	2.60 cts.
Rate per mile (night)	4.90 cts.	4.09 cts.	4.27 cts.	2.67 cts.

COMPARISON OF GERMAN SECOND CLASS WITH AMERICAN FIRST CLASS RATES

(Through Express Trains)

	Berlin to Hamburg	New York to Baltimore	Berlin Eisenach-Frankfort	New York to Lyons, N.Y.
Distance (miles)	178	187	331	335
Railway fare	$3.78	$4.65	$6.65	$6.96
Baggage charge (150 lb.)	.95	Free	1.43	Free
Total charge (day)	4.73	4.65	8.08	6.96
		Upper berth		Upper berth
Sleeping car	1.55	$1.60	1.90	$1.60
Total charge (night)	6.28	6.25	9.98	8.56
Rate per mile (day)	2.66 cts.	2.49 cts.	2.44 cts.	2.08 cts.
Rate per mile (night)	3.53 cts.	3.34 cts.	3.02 cts.	2.56 cts.

It is seen that it costs about 30 per cent more to travel first class in Germany than it does to travel by Pullman parlor or sleeping car in the United States, and it even costs a little more to travel second class in Germany than first class in the United States.

Rates—Freight.—High as German passenger rates are, German freight rates are so much higher that if the railroads of that country were as economically managed as ours are, they could afford to carry all their passengers free and still make larger profits than they do now, or, to put it another way, if American railroads had been permitted to charge the same average freight rate in 1914 that German railroads charged prior to the war, they could have carried all passengers free, paid the cost of digging two Panama canals, constructed the proposed government railway in Alaska and surprised many discouraged stockholders by the distribution of slight tokens in the shape of dividends.

To be more definite, the latest official reports show average receipts per ton mile as follows:

Germany	(1912)	1.370 cents
United States	(1914)	.728 cents

It would, therefore, require a horizontal increase of 88 per cent in American freight rates to put them on a par with those of Germany.

Many unthinking people have been led to believe that this big difference in freight rates is explained by the relatively greater average length of haul in the United States, and by the fact that the high class package freight which is handled by the express companies in the United States is carried as ordinary freight in Germany. Neither of these theories will bear analysis.

The average length of haul has much less influence on the cost of carrying freight than many people suppose. If length of haul were the determining factor, then the Russian government ought to carry freight and passengers on its Trans-Siberian railway at the lowest rates in the world. Needless to say, such is not the case. The "long haul" theory will not explain the following differences in average rates:

	Germany	U. S.	Group III*	Group VII§
Average length of haul....	62	149	125	235
Receipts per ton mile.....	1.370 cts.	0.728 cts.	0.581 cts.	0.902 cts.

Here we have (comparing Groups III and VII) the longer haul paying the higher freight rate. It would, of course, be foolish to conclude from this comparison that a longer average haul tends to increase the average rate per ton mile. The fact is that the length of haul is of quite minor importance. The two biggest factors in reducing rates are efficiency of management and density of traffic, the latter depending largely on density of population per mile of line. The population per mile of line in the United States is about 390, in Group III,* 500, and in Group VII,§ 100. In these figures lie the true explanation of the differences in average rates between Group III, Group VII and the United States as a whole. Now, Germany has a population 4½ times as dense per mile of railway as the United States, but the management is so inefficient that instead of freight rates being lower than in this country, they are nearly twice as high.

Of course, there is absolutely no question that, other things being equal, the ton mile rate should be less for a long than for a short haul, due to the terminal expenses which in the former case can be distributed over a greater number of miles. However, German railways make an extra charge for terminal expenses, thereby eliminating the disadvantage of the short haul from a revenue standpoint. No opportunity to collect an extra *pfennig* is overlooked. For example, the German shipper is charged for his bill of lading and also for the time of the employee who makes it out.

With regard to the effect the inclusion or exclusion of the express receipts have on the average freight rates, it is only necessary to call attention to the fact that in 1914 the total receipts from express in the United States amounted to less than 2½ per cent of the railroads' earnings. Another important fact in this connection was pointed out in a report by the American Consul-General at Berlin (in the year 1911) as follows:

> It should be noted that so far as small parcels are concerned, the great part of the express business for Germany is done through the post office, per parcels post. The weight of a package must not exceed 50 kilograms (110.2 pounds).

Cost of Living.—So far we have not taken into consideration the difference in the purchasing power of a dollar in Germany and the United States. Volumes might be written on this subject and a different conclusion reached in each volume, depending upon the selection of commodities used as a basis for comparison. From the standpoint of the average citizen, the real test to be applied to the railways of his country is: How much transportation (passenger and freight) can I buy with my day's wages? Using the average earnings of the railway employees in each country as a basis, we find

*Group III, according to Interstate Commerce Commission classification, comprises railroads of Ohio, Indiana, and parts of adjacent states of Pennsylvania, New York and Michigan.

§Group VII comprises railroads of Montana, Wyoming and parts of adjacent states.

that a week's wages will pay for any one of the following items of transportation:

IN GERMANY

Passenger journey, first class	211 miles
Passenger journey, first class (including berth)	170 miles
Passenger journey, second class	311 miles
Passenger journey, second class (including berth)	238 miles
One ton of freight	567 miles

IN UNITED STATES

Passenger journey, first class (including parlor car seat)	553⅞ miles
Passenger journey, first class (including lower berth)	460 miles
Passenger journey, first class (day coach)	682 miles
Passenger journey, first class (including upper berth)	527 miles
One ton of freight	2,135 miles

Therefore, it may be conservatively stated that in Germany under government ownership of railways the people pay twice as much as Americans pay for the same quality of passenger service, and nearly four times as much for freight.

The profits made by Germany out of her railways appear on the face of the official reports to be very large, but this is to a great extent a pleasant little matter of bookkeeping. For example, many renewals and replacements that American railways charge to operating expenses, the German railways capitalize just the same as new construction. That is, they make profits by the simple expedient of mortgaging the future. As a result of this policy, the capitalization per mile of line on German railways has increased more than $20,000 during the past 21 years and in 1912 had reached a total of $116,662. American railroads, in spite of their greater cost of construction and including the supposedly large amount of "water," had a total capitalization of only $63,094 per mile in 1914.

Whatever profits the German railways do actually make are offset to a considerable extent by the fact that they pay no taxes, while this item cost the railways of the United States 4.6 per cent of their gross earnings in 1914.

To sum up the situation, we have seen that the German railways charge twice as much for carrying passengers, nearly four times as much for hauling freight, pay no taxes, and yet are able to show big profits only by borrowing money to pay for improvements that American railroads pay for out of their earnings.

One cannot help wondering whether our own government could do even as well as the Germans do.

THE REWARDS OF SUCCESS*

By Geo. A. Post

President, Railway Business Association

Those who have been so enthusiastic in enacting restrictive measures to avert what they deemed the national danger that the railways might earn too much, little dreamed that the time would soon come when a really grave national danger would be that the railways might not earn enough in the public interest.

The great, crucial question pressing for solution is: Whether earnings are sufficient for railroad needs? Those needs are created by the demands of the growth of the country, by the demands of labor, which generally appeal to the sympathies of the public, or their fears lest transportation movements may be interrupted by strikes. These financial needs of the railway are created further by the demands of government for improvements in facilities, safety appliances, taxes, conveniences, sanitary precautions valuation appraisals, a multiplicity of costly inspections and special reports upon a myriad incidents of operations.

When the railroads have gone to the body from which alone they may secure permission to augment their resources, and plead their necessities, elaborate and long-drawn-out debates have ensued as to the authority of the Interstate Commerce Commission to consider the financial results of operation in determining rate cases. The whole process of readjusting rate fabrics in the various regions has been retarded by the expressed belief of at least some of the commissioners that the commission had no authority to sanction advances, otherwise unreasonable, for the sole purpose of increasing revenues.

Notwithstanding that lawyers of high prestige believe that the act creating the commission and those acts enlarging its powers as interpreted by the courts already, bestow upon the commission all needed power, yet, as some of the commissioners, undoubtedly honest in their convictions, reject this view, the process of invigorating the roads and restoring their active development, lags.

Such a dispute ought not to continue. So long as the commission doubts its power, it will not act. It derives its existence and powers from Congress, of which it is an arm, and Congress can and should by statute declare it the policy of the government to permit such a system of rates as will yield earnings sufficient to attract investment for improvements and extensions.

Congress would thereby in effect announce the rule fair to all railroads: "If you fail on rates which enable the average road to live and prosper, you ought to fail, and the government will not protect you against failure; if on rates under which the average road can live and prosper, you can earn large dividends, your right is to earn them, it is in the public interest that you should earn them, and the government will protect you in their enjoyment."

Public opinion brought to bear upon Congress can bring about such an enactment. I know that many thoughtful minds are giving voice to conflicting theories regarding the proper financing of our public utilities. Some would absolutely limit all profits, while making no guarantee against loss. Some would limit profits, but guarantee a minimum dividend by the government to subscribers to stock, the government to take all above the maximum dividend allowed. The guaranteed minimum has been suggested as three per cent, and the maximum as six per cent.

My friends, as an American, such theories are repugnant to what I conceive America to be. My soul revolts at the thought that this country, the land of opportunity, the land of great risks and great rewards, shall say to investors, inventors, executives, and the rank and file of workers in the railway realm: "We insure you against failure, but we estop you against great success!" If that is to be the shibboleth of America regarding its railroads, soon all enterprises of importance would be included in the propaganda. Under such conditions what a farce would be the celebration of the Fourth of July! We may no longer tell our children that illimitable opportunities beckon them to a future of adventure, fortitude, courage and hard work, with risks appalling, but reward possible that shall make them famous and rich.

How shall we spur on the naturally lazy and shiftless, or curb the reckless if they are sure of being three per centers without determined effort or the exercise of prudence? How shall we keep blazing the fires of ambition in eager souls if naught of brilliance, indefatigable energy, thrift and self-denial can overleap the hurdle of a beggarly six per cent return for the best there is in them? How can capital be lured from its hiding places in vaults to build railroads and factories, tunnel the mountains, or develop mines, if the possible rewards are not commensurate with the risks? How can we raise industrial giants, and inculcate intrepidity of commercial spirit on a six per cent diet?

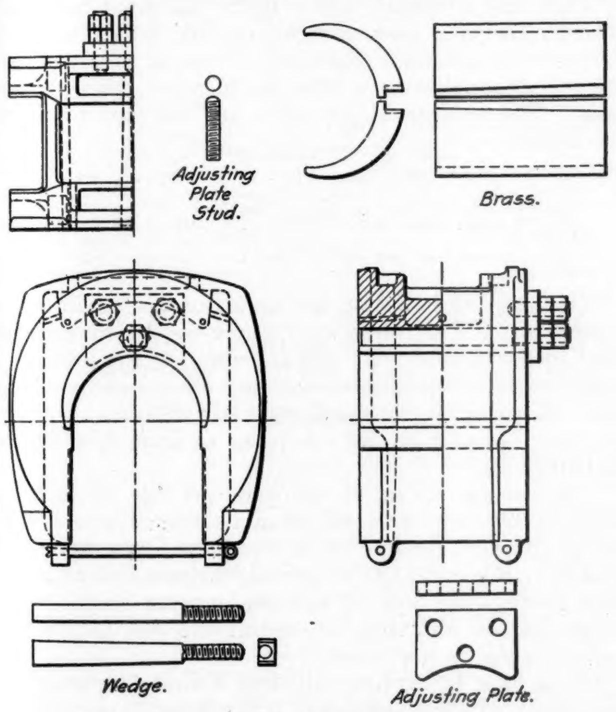
Is it to come to pass that in America we shall put genius in shackles and put a premium on inefficiency? Who is going to lustily sing: "America, I love you!" on an assurance only of crackers and cheese all round for leaners and lifters alike, with no roast beef and pie for the strenuous and gifted lifters? It will be a sad day for America when in the race for life's prizes everybody does not start at the

*Abstract of an address at the dinner of the New York State Bankers' Association, Atlantic City, N. J., June 9, 1916.

scratch, with no handicaps except those put there by the act of God. Make the rules governing the race stringent and absolutely fair to all; banish from the track and into hated exile all gougers; penalize heavily all tricksters; provide for honest starters and impartial judges, and then: hurrah for the winner! We have established munificent private and public benefactions for the relief of the unfortunate not as badges of distinction but as solace for distress. It is no part of the function of the government to endeavor to protect the individual against failure. It cannot be done. Nothing will protect from failure the man who hasn't it in him to make good. Nothing should limit the reward of him who possesses the rare faculty for the service of mankind.

SECTIONAL DRIVING BOX BRASS

The illustrations show a departure in sectional locomotive driving journal bearings or brasses. The Langton brass, of which there are now 270 in service, has been designed with a view to simplifying the operation of applying and removing such brasses. This operation, heretofore, has involved the shopping of the locomotive, dropping the wheels and



Langton Driving Box Brass

otherwise dismantling, with an attendant expense, including the loss of the earning capacity of the locomotive, often amounting to $125 or more. With the use of the Langton brass it is possible to crown a pair of journals in less than two hours, at a cost of less than $3.00, without the use of a drop pit or any other facilities than a journal jack, making it possible to do the work during the lay-over period, consequently the locomotive need not miss its regular run. Brasses can be closed on the journal in less than 30 min.

No change of existing patterns of boxes or brasses is required. The solid brass is simply split lengthwise and provided with a tapered groove or key-way at the top to receive a tapered key or wedge which forms the adjusting means. A small holding plate fastened to the inside face of the box by means of two studs completes the arrangement. It can be manufactured at any shop having a lathe, planer or shaper, and drilling machine, and can be applied at any roundhouse.

In applying a solid brass, the driving box, weighing several hundred pounds, has to be handled and trucked a number of times, while with the Langton brass the heaviest part moved is the brass itself. This brass has been in service nearly two years on all classes of power and has demonstrated its entire practicability. It has been developed by J. W. Small and G. H. Langton, Portsmouth, Va.

OWNERSHIP OF RAILWAY STOCK

Ownership of the stock of American railways at the close of the fiscal year ended June 30, 1915, was distributed among 626,122 stockholders. This is according to a compilation just made by the Bureau of Railway Economics from the returns of the railways to the Interstate Commerce Commission. The average holding is $13,796 par value. The statistics cover 1,285 railway corporations having an aggregate mileage of 257,211 miles. Of these roads 842 are operating companies owned by 539,118 stockholders, and 443 are non-operating roads owned by 87,004 stockholders. This represents an average of 640 stockholders per railway for operating roads, 196 stockholders for non-operating roads, and 487 stockholders per railway for all roads. The total par value of outstanding capital stock is $8,638,286,892. There are included in the compilation 170 Class I roads, with annual operating revenues of $1,000,000 or over; 267 Class II roads, with revenues between $100,000 and $1,000,000, and 405 Class III roads, with revenues of less than $100,000.

Corresponding data for the year ended June 30, 1914, were published in the *Railway Age Gazette* of July 30, 1915. Owing, however, to change in the methods of classifying and reporting railway stock beginning with the fiscal year 1915, the statistics for the two years are not on bases which are entirely comparable. The change in reporting was made at the instance of the Interstate Commerce Commission. The accompanying table shows data in detail divided according to the three districts into which the Interstate Commerce Commission subdivides its statistics as to number of roads, number of stockholders on June 30, 1915, par value of outstanding capital stock, par value of average amount of capital stock per stockholder, and miles of line operated.

NUMBER OF STOCKHOLDERS AND AVERAGE HOLDING PER STOCKHOLDER ON RAILWAYS OF THE UNITED STATES, JUNE 30, 1915

District and Class	Number of roads	Number of stock-holders	Capital stock outstanding. Par value	Average amount of stock per stockholder. Par value	Miles of line operated
UNITED STATES—					
Operating Roads:					
Class I	170	511,187	$6,829,820,715	$13,361	228,679
Class II	267	10,604	372,702,236	35,147	19,716
Class III	405	17,327	111,561,782	6,439	8,816
Total operating roads	842	539,118	7,314,084,733	13,567	257,211
Non-operating Subsidiaries:					
Class I	410	86,347	1,318,591,424	15,271	....
Class II	16	180	3,338,600	18,548	....
Class III	17	477	2,272,135	4,763	....
Total non-operating subsidiaries	443	87,004	1,324,202,159	15,220	....
Total United States..	1,285	626,122	8,638,286,892	13,796	257,211
EASTERN DISTRICT—					
Operating Roads:					
Class I	68	244,288	2,489,976,817	10,193	58,921
Class II	88	4,739	129,089,286	27,240	4,420
Class III	102	4,051	26,899,788	6,640	1,780
Total operating roads	258	253,078	2,645,965,891	10,455	65,121
Non-operating Subsidiaries:					
Class I	280	79,005	746,769,047	9,452	....
Class II	6	74	1,149,000	15,527	....
Class III	10	269	1,078,250	4,008	....
Total non-operating subsidiaries	296	79,348	748,996,297	9,439	....
Total Eastern District	554	332,426	3,394,962,188	10,213	65,121
SOUTHERN DISTRICT—					
Operating Roads:					
Class I	33	48,106	974,391,461	20,255	41,880
Class II	59	2,767	75,357,750	27,234	4,890
Class III	127	1,959	31,375,314	16,016	2,768
Total operating roads	219	52,832	1,081,124,525	20,463	49,538

Non-operating Subsidiaries:					
Class I	51	4,644	71,503,725	15,397	....
Class II	3	34	247,000	7,265	....
Class III	5	196	687,885	3,510	....
Total non-operating subsidiaries	59	4,874	72,438,610	14,862	....
Total Southern Dist.	278	57,706	1,153,563,135	19,990	49,538
WESTERN DISTRICT—					
Operating Roads:					
Class I	69	218,793	3,365,452,437	15,382	127,878
Class II	120	3,098	168,255,200	54,311	10,406
Class III	176	11,317	53,286,680	4,709	4,268
Total operating roads	365	233,208	3,586,994,317	15,381	142,552
Non-operating Subsidiaries:					
Class I	79	2,608	500,318,652	185,441	....
Class II	7	72	1,942,600	26,981	....
Class III	2	12	506,000	42,167	....
Total non-operating subsidiaries	88	2,782	502,767,252	180,722	....
Total Western Dist.	453	235,990	4,089,761,569	17,330	142,552

For Class I roads, operating 228,679 miles, the average holding per stockholder was $13,361. For Class II roads the average holding was $35,147, and for Class III roads it was $6,439. The average holdings per stockholder in non-operating subsidiary roads was $15,220. In each of the three districts the average holdings for operating railways of Class II were larger than the averages for roads of Class I. The average holdings per stockholder in Class II operating roads in the Eastern district were $27,240; in the Southern district, $27,234; in the Western district, $54,311. The holdings in operating roads of Class I were, Eastern district, $10,193; Southern district, $20,255; Western district, $15,382.

The number of individual railway stockholders is somewhat smaller than the totals here given for the reason that the aggregate number as reported by the commission is the number of distinct holdings of stock and does not necessarily represent the number of individual holders. Non-operating subsidiaries are to a large extent, also, owned or controlled by other railways, which results in a comparatively small number of stockholders on the average. The average holding per stockholder generally is not large. An exception to this rule is found in subsidiary roads of Class I in the Western district. In this group 79 roads show an average holding per stockholder of $185,441. This is entirely due to the inclusion of several lessor railways with large capital stock whose ownership vests in each case in a single controlling railway. For example, the Carolina, Arizona & Santa Fe, with a capital stock of $50,000,000, is controlled by the Atchison, Topeka & Santa Fe, which owns all of the stock except $500, which is distributed among five directors. A similar instance is the Central Pacific, all of whose $84,675,500 of stock except $900 is owned by the Southern Pacific.

In order to ascertain how widely railway stock is distributed and in what amounts among the general public, the Bureau of Railway Economics in its compilation has attempted a partial elimination of the holdings of stock by the railways. The elimination is only partial for the reason that complete elimination would be impossible except by an investigation of the stock books of all railways.

Beginning with the fiscal year 1915 the Interstate Commerce Commission required every operating railway of Class I and Class II and every non-operating railway to report the names and holdings of its 20 largest stockholders. This enables a partial separation of stock holdings in the hands of railway corporations from those in the hands of individuals. The separation is not complete for the reason that the operating railways of Class III are not represented because they are not required to make returns of their 20 largest stockholders, and the list of railway corporations stockholders in other railways is not complete, nor the total amount of their holdings. Considering the statistics from this point of view it appears that there were 688 railway companies holders of stock and $2,519,956,813 of stock were so held. This leaves a total of $6,004,496,162 of capital stock in the hands of 607,630 stockholders. This number may be considered as comprising the general public. On this basis, the average holding per stockholder for the United States as a whole is $9,882; in the East, $7,158; in the South, $15,928, and in the West, $12,365. The effect of this elimination is strikingly shown when it is applied to subsidiary roads of Class I in the Western district, which, as before mentioned, show an average holding per stockholder of $185,441. When the large railway holdings have been eliminated this average becomes $13,281 per stockholder.

ECONOMY ON THE PART OF EMPLOYEES

John Howe Peyton, president of the Nashville, Chattanooga & St. Louis, has issued the following circular to employees, calling attention to the increases in the prices of materials and urging economy:

"The interest of the employees and that of the company are identical. The company's success may be measured by the energy and fidelity displayed by its employees, individually and collectively, in watching its interests, and the company's success betokens the degree in which, ultimately, it can share the benefits of that success with its employees.

"There are frequently times, under abnormal conditions, when the company must overcome unusual difficulties. The present is an abnormal condition. Prices of nearly all materials and supplies have risen to, in many cases, unusual levels. The increases shown below are indicative of general conditions:

Ink and ink powders	30 to 75 per cent
Pencils—black	20 per cent
Pencils—copying	100 per cent
Writing paper—according to quality	40 to 100 per cent
Lumber	30 to 40 per cent
Manufactured iron and steel articles	100 to 200 per cent
Waste	50 to 60 per cent

"The company is feeling the burden of this condition. It is peculiarly a time when loyal employees, by conscientious effort in the care of tools, use of materials, conservation of supplies and avoidance of waste, may effect substantial savings. Economy, in time and material, always a commendable trait, is under present conditions an imperative duty on the part of all.

"The average saving of one dime per day by each employee of this company would mean a saving of over $3,000,000 in 10 years, the interest on which, at 5 per cent, would produce a fund of $12,500 per month, sufficient to meet a large pension roll and in addition provide funds for the maintenance of an extensive accident and sick benefit association among its employees.

"If we must be extravagant—let's squander our smiles; be free with kindnesses and lavish with courtesies to our fellow employees and the vast army of patrons who entrust themselves and their substance to our care. Thus will our structure be builded on a rock: and working harmoniously as one great organization, we will advance in the confidence of an ever-increasing number of friends along the pleasant paths of duty well performed toward the goal of permanent and satisfying success."

ALASKA COAL FIELDS OPENED TO ENTRY.—Official announcement by Secretary Lane of the Interior Department was made June 2 that regulations have been issued under which private individuals and corporations may without further delay begin the leasing and operating of the extensive anthracite and bituminous coal fields of Alaska. Ten years have elapsed since the Alaskan coal fields were withdrawn from private entry and development. The regulations are accompanied by maps and important general information regarding the lands in question. Copies may be secured on application to the Commissioner of the General Land Office. —*Engineering and Mining Journal.*

Grade Crossing Elimination at Cleveland

The New York, Chicago & St. Louis Will Depress Its Tracks for a Distance of 2½ Miles by a Novel Method

THE New York, Chicago & St. Louis has commenced work on a grade separation project at Cleveland, which involves the depression of the tracks below the grade of the streets for a distance of about 2½ miles. Because congested traffic conditions made excavation by steam shovel and work trains undesirable, an investigation was made to determine whether any other means of moving the material could be found. This led to the adoption of the hydraulic method, which is most unusual in grade separation work. Twenty-four street crossings are involved, 13 of which will be carried over the tracks. In addition to these, foot bridges are to be constructed at points to be designated by the director of public service.

As this work has been undertaken at the request of the city, 35 per cent of the expense under the Ohio law, will be borne by the city and 65 per cent by the railroad. The bonds for the city's proportion of the expense, amounting to $725,000, were voted on Sept. 6, 1910. At that time the railroad was engaged in a similar undertaking on the east side of the river, and to undertake a second project would have seriously interfered with its transportation. For that reason the city has refrained from pressing the matter until the first project was completed and time had elapsed for the acquisition of additional right of way.

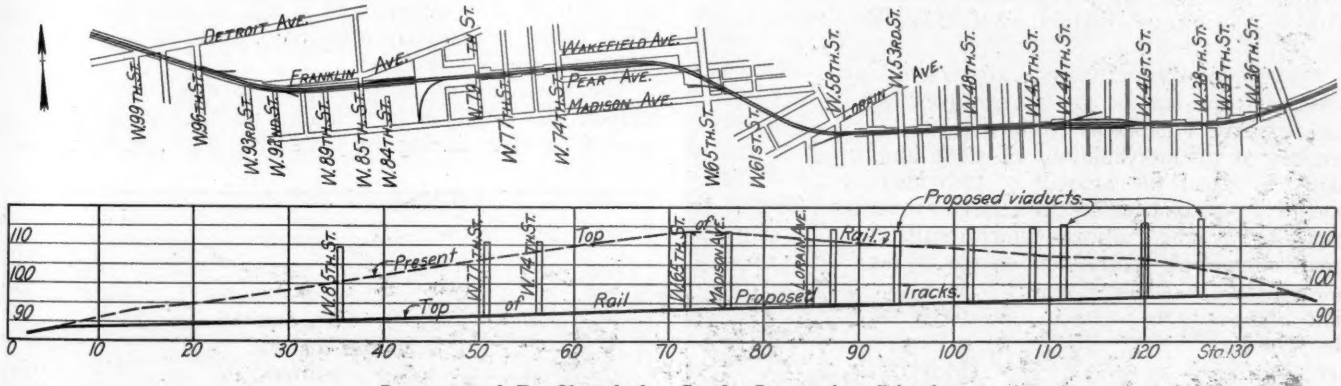
At present there is a summit near the center of the territory affected which renders it impracticable to elevate the tracks. The plan contemplates a through cut throughout the whole distance, eliminating this summit and passing 20 ft. below the present grade at West Sixty-fifth street. There are two main tracks through the city, and preliminary studies indicated that the total expense that might be incurred for the construction of a four-track roadbed at the new grade would be only slightly greater than the expense of constructing a two-track roadbed. Inasmuch as the improvement when complete could thereafter be altered only at very great expense, which would be entirely out of proportion to the benefits that might be derived from the use of a third and fourth track, it was decided to construct the four-track roadbed at once.

The right of way was irregular and in some places narrow. At one point its width was 40 ft.; in other places the land owned by the company was sufficiently wide to make an average width throughout the whole distance of 75 ft. East of Sixty-fifth street the additional right of way was acquired wholly on the northerly side of the tracks. West of Sixty-fifth street it was impracticable to do this and temporary running tracks, about 4,000 ft. in length, will be constructed from Lorain avenue to West Ninety-sixth street along the southerly edge of the right of way. A through cut will then be made throughout the entire distance of a width sufficient for two tracks. Upon its completion these two tracks will be constructed complete and traffic turned over them, thus permitting the abandonment of the present tracks and the temporary running tracks and the completion of the excavation.

The disposition of the excavated material presented a very serious problem. The location finally decided on for its disposition is along the route of the Big Four in a valley called Walworth run. About 15 or 18 years ago a large sewer was constructed in the bed of this run to take care of the natural flow and a large amount of sewage. The valley has remained unoccupied and in a very unsightly condition. The officers of the city felt that the grade crossing improvement afforded an opportunity to secure material to improve the valley and make it available for industrial purposes. With this in mind steps were taken to secure authority from the property owners to deposit the material along the run. A careful study of the undertaking was made with a view to the removal of the material with a steam shovel and work trains, but it was found quite impossible to place the material where desired by these means. The grade that would be required for a track into the run would be about 3.4 per cent, but the alinement of the track would have been so irregular as to make it impracticable to reach sufficient ground to care for all of the material.

It would have been impossible to handle any material over the Big Four transfer because of interference with regular traffic. Another difficulty which would be encountered in the transportation of material by cars was the interference with traffic throughout the whole length of the improvement, which is very heavy at times. Single-track operation would have been extremely difficult, if not impossible. Preliminary test borings showed that the material to be removed is largely sand with a slight mixture of clay, and that below the city sewers it is very wet, the bottom of the cut throughout resting in a deep bed of quicksand. This quicksand would render the operation of a steam shovel exceedingly difficult. Because of the difficulties thus enumerated an effort was made to find some method of performing the work which would be more applicable to the situation.

It happened that the city has for some time been engaged in the construction of a new pumping station on the west side of the city, and to provide for future growth its capacity was in excess of present needs. Several large water mains



Layout and Profile of the Grade Separation District

of 30 to 36 in. diameter intersect the railroad and must be depressed beneath the proposed excavation. The material to be excavated is of a nature that can readily be handled with pumps, and the run into which the city desired to place the material is drained directly into the river by a sewer of large capacity. Because of these conditions, which were unusually favorable for hydraulic grading, a careful study was made to determine the possibilities and economy of that method.

Preliminary estimates were made for this proposed excavation by means of the hydraulic method. The engineers representing the city and the railroad were so favorably impressed with the advantages to be derived from the use of this method that a decision was quickly reached to proceed with plans to perform the grading in this way. A further condition which weighed strongly is that because of the large number of streets to be crossed the annoyance and danger to street traffic as well as the interference with rail traffic would have been almost intolerable with ordinary methods.

Constructing Retaining Walls in Trenches

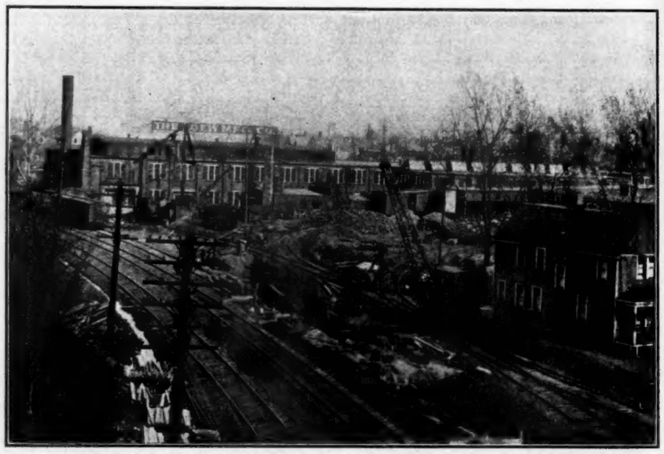
To provide a suitable roadbed for rail traffic in the quicksand after the completion of the excavation, an elaborate drainage plan has been prepared, which will be carried out prior to the use of the new roadbed. It is expected that the thorough drainage of the water will make the ground firm and hard so that it will be possible to operate trains through the cut.

Work was begun in September, 1915. About 100 houses have been sold and removed from the right of way. A retaining wall has been constructed along the plant of the V. D. Anderson Company near West Ninety-sixth street, shown in two of the accompanying photographs. It is necessary to build a few retaining walls such as this for the protection of the various manufacturing plants prior to the excavation. The construction of the walls is expensive because of the necessity of excavating trenches in which to build them, but it will be impracticable to remove the earth from the roadbed prism without so doing. Throughout the major portion of the work earth slopes will be used instead of retaining walls, the construction of the walls being much more costly.

In some places industrial tracks will be connected with the railroad at the new grade, using three and four per cent grades to reach the ground surface. One of the photographs illustrates such an arrangement of tracks already completed to serve three industries. Double-track street car lines with very heavy traffic cross the railroad at Lorain avenue and West Sixty-fifth street. The proposed method of excavation will permit the working of a full face at the end of the cut and the pumps and motors will, therefore, pass below the grade of these streets, and it will be possible to restore street traffic immediately after the excavation by means of temporary wooden bridges.

Buried Retaining Wall Completed

The work will all be performed by direct labor. That method was employed in a similar undertaking on the east side of the river during the years 1909-1913, inclusive, and the results were quite satisfactory. It would be extremely difficult to prepare a contract covering such work, and in most instances where such work has been performed by contract there have been large bills for force accounts and extras.



New Industry Connection Track on the Right

An unusual feature of the hydraulic grading is the great length of pipe line which at a maximum will be about 11,000 ft. The pumps are designed to discharge 4,000 gal. per min. under heads of 125 ft. It is intended to distribute these pumps along the line and use them as boosters, this method being considered better than to install sufficient power at the end of the line to maintain the necessary velocity throughout the whole length of the pipe. The latter case would result in very high pressure and require stronger piping. It would also require a pump of greater capacity which would be needed except under maximum conditions.

The pumps are being manufactured by the Morris Machine Company, Baldwinsville, N. Y. The peculiarity of the pumps is that in service the wear is so great that the details which conform to careful theoretical design quickly wear

away and produce a condition under which the theoretical efficiency cannot be maintained. It has been found by experience that certain modifications of the designs indicated by theory result in a better average service and life of the pumps. The power to drive the pumps will be obtained from the municipal electric light department of the city. The motors will be mounted on the shafts carrying the pumps, the motor and pump being moved from place to place as a single unit.

This work is under the direction of E. E. Hart, chief engineer of the New York, Chicago & St. Louis, and A. J. Himes, engineer of grade crossing elimination, to whom we are indebted for the above information.

LUBRICATOR FOR LOCOMOTIVE AIR PUMPS

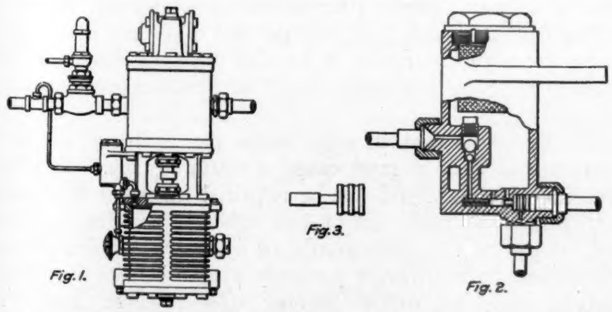
The subject of locomotive air pump lubrication is one which has not been given a great deal of consideration by the mechanical departments of most of the railroads of this country. The lubrication of the steam cylinder is usually taken care of in one of three ways:

Where locomotives are equipped with hydrostatic lubricators for lubricating the engine cylinders, an additional feed is supplied on the lubricator and connected to the steam cylinder of the air pump;

Where locomotives are equipped with force-feed lubricators for lubricating the engine cylinders, an additional pump is supplied for furnishing lubrication to the steam cylinder of the air pump;

In some instances a separate single feed hydrostatic lubricator is applied to the locomotive.

None of these schemes is entirely satisfactory, as, in the



Air Pump Lubricator for Both the Air and Steam Cylinders

first case, the lubrication of the steam cylinder of the air pump is placed in the hands of the engine crew, with the natural result that oil is fed continuously, regardless of the amount of work which the pump is doing. This objection applies also to the third scheme.

The second scheme is open to the objection, and it is a serious one on heavy freight power, that lubricant is furnished the steam cylinder of the air pump when the locomotive is in motion only, and it will be fully appreciated that it is at this time that the air pump on a heavy freight locomotive requires the least amount of lubrication. When a locomotive so equipped makes a stop with a long train the air pump is usually required to make several hundred strokes in recharging the train line, during which time it will in many cases become so dry as to interfere seriously with its operation and efficiency.

The lubrication of the air cylinders of locomotive air pumps is generally taken care of even more inadequately than is the lubrication of the steam cylinders. Neither the hydrostatic lubricator nor the ordinary force-feed lubricator is a satisfactory device with which to lubricate the air cylinders, as in either case the oil is introduced in amounts in excess of what is required, and in a form which is not best suited to the lubrication of the hot dry cylinder walls and the valves. It is the practice generally to introduce oil into the air cylinders through what is commonly known as an oil cock applied to the top head. With this arrangement someone is depended upon to fill the cup with oil, open the cock and allow it to flow down into the cylinder when the pump is not in operation. This method is not conducive to good results on account of the fact that as a general proposition oil is not applied until indications of its need are observed; also on account of the fact that when oil is introduced it is in such quantities and in such form as to carbonize on the walls of the cylinder and to gum up the discharge valves. Further, the lack of facilities for properly lubricating the air cylinder leads to the objectionable practice of pouring oil on the outside of the intake strainer, which tends to gum it up, causing dirt to collect in such quantities as to restrict the free passage of air through the intake, and interfering with the capacity and efficiency of the pump.

With the view of overcoming these difficulties and furnishing lubrication to air pumps in proportion to the amount of work done, the lubricator illustrated has been designed by O. C. Wright, assistant engineer of motive power, Pennsylvania Line, Fort Wayne, Ind., and patents applied for. Fig. 1 shows the lubricator as applied to a Westinghouse 9½ in. air pump. Fig. 2 shows a section through the operating parts of the lubricator; Fig. 3 shows the operating member of the lubricator in detail.

Referring to Fig. 1, it will be noted that three connections are made to the lubricator. No. *15* leads to the pipe supplying steam to the steam cylinder; *12* to the top head of the air cylinder, and *14* to the air inlet of the air cylinder.

Referring to Fig. 2, it will be noted that connection *12*, being made to one end of the air cylinder, provides a means for creating alternate vacuum and pressure in the cavity *P*, which produces a reciprocating motion of the operating member; in other words, one cycle of the air pump produces a complete stroke forward and back of the operating member. In the backward stroke a quantity of oil is drawn from the cup *L*, through the port *V*, into chamber *Q*, a part of which on the forward stroke is forced through the passage *Y*, past the double ball check valves *5* and *6*, into the connection *15*, and thence to the steam supply pipe of the steam cylinder. Simultaneously with this operation on the back stroke of the operating member a small quantity of oil is drawn from the cup *L*, through the port *U*, into the chamber *P*, and on the forward stroke part of the oil is forced through port *S* into connection *14*, thence through the air inlet past the inlet valves and into the air cylinder. This oil enters the cylinder in an atomized state on account of its mixture with air during its ejection from chamber *P*. From the foregoing it will be noted that on each stroke of the pump a quantity of lubricant is supplied to both the steam and air cylinders, which quantity can be regulated by the proper proportioning of the ports *U* and *V* and locating them with proper relation to the limits of travel of the operating member. It will be noted from Fig. 1 that the bolting flange *J*, Fig. 2, is attached to the lowest steam cylinder head, which not only serves as a convenient method of supporting the lubricator, but also affords a means of conducting heat from the steam cylinder, maintaining the oil in the lubricator at practically constant temperature under all weather conditions.

It is believed that the application of this device will be found to result in not only a reduction in the amount of oil used and the number of train detentions on account of air pump failures, but also in an appreciable reduction in the cost of maintaining the pumps.

Production of Cement in 1915.—The production of Portland cement in 1915 totaled 85,914,907 barrels, of which 24,876,442 barrels were produced in the Lehigh district of eastern Pennsylvania and western New Jersey, 10,242,869 in the Illinois and northwestern Indiana district, 9,186,401 in Iowa and Missouri and the remainder in other states.

Conference on Wage Demands of Train Employees

Railway Committee and Officers of Brotherhoods Practically Conclude Negotiations Begun on June First

NEGOTIATIONS between the National Conference Committee of the Railways and the officers of the four brotherhoods of train service employees over the wage demands of the latter were practically broken off on Wednesday of this week when the brotherhood officers definitely announced that they would not accept the railroads' contingent proposals providing for a modification of other provisions in the present schedules in connection with any settlement under their demands. They said they would not accept them even if the railroads would accept the brotherhood proposals as so modified. The conference was then adjourned until Thursday morning when the railroads were to present a formal statement of their reply.

The principles which the railroads insisted on and which the brotherhoods declined to consider are as follows:

"(a) No double compensation for the same time or service.

"(b) Same classification for purposes of compensation to be applied to all members of train and engine crew.

"(c) Two or more differently paid classes of service performed during the same day or trip to be proportionate rates according to class of service, with not less than a minimum day for the combined service."

It was distinctly stated that the railroads made no counter-proposition but that these proposals were contingent upon a change in the present basis of rates.

The break came without any argument on either side and without any consideration of the merits of the entire controversy.

Most of the time of the conferences has been taken up with the detailed discussion of the application of the brotherhoods' proposals and of the railroads' proposals to specific instances, without argument on either side, but since Monday of this week it has seemed evident that no agreement could be expected.

The proceedings during the first week of the negotiations were reported in last week's issue. The conference was adjourned early on Thursday, June 8, until Monday, June 12, to give the railroad committee additional time in which to formulate answers to a series of 110 questions propounded by the brotherhood officers for the purpose of ascertaining definitely how the compensation of the men would be affected by the application of the principles announced by the railroads in their contingent proposition stated in reply to the demands of the brotherhoods. The brotherhood leaders seemed especially interested in proposition (a) of the railroad statement, that there should be no double compensation for the same time of service.

An early break in the negotiations seemed imminent soon after the opening of the Monday morning session. Elisha Lee, chairman of the conference committee, announced that the committee had decided upon answers to the questions and that in doing so it had applied a "yardstick" in the form of a principle which it considered fair to both sides and which it believed applied to most of the cases cited in the questions. This "yardstick" he stated as follows:

A road man's time will start from the time he is required to report for duty and except where tied up between terminals in accordance with existing agreements, all work and delay required at initial terminal and en route will be paid as continuous time or mileage. At final destination, existing rule or rules concerning additional service after arrival, final terminal delay, etc., not to be disturbed, and will be paid for pro rata until the time on duty equals the overtime limit of the run. Time paid for under one rule not to be paid for under another rule or rules.

This, he said, in reply to questions by A. B. Garretson, president of the Order of Railway Conductors, would abolish all initial and intermediate arbitraries and would provide for the payment of overtime rates only in case overtime actually accrued. It would leave final arbitraries in effect as allowances to be paid if overtime did not accrue. That would not go into effect, he said, if the present schedules were not changed by the brotherhoods' demands, and if they were modified the railroad proposal might be modified.

"Ours is not a modifiable proposition," said Mr. Garretson. "It is it, or nothing. It contains only two parts, and the demand for punitive overtime is nothing but an incentive to conform to the eight-hour day. If that is the deliberate position of your committee I say to you frankly that there is no reason for the continuance of these conferences. It is impossible to arrive at what might be known as a compromisable proposition, because if we abandon the overtime the eight-hour day is not an iota better than a 10-hour day." He argued that the elimination of the arbitraries would reduce the earning power of the men.

"But if you give them a day's pay for eight hours and also time and a half for overtime you increase their earning power tremendously," said Mr. Lee. Mr. Garretson insisted that a large amount of overtime is controllable and that when the railroads rearrange their running time to reduce the overtime and then eliminate the arbitraries also the pay of the men would be reduced with the eight-hour day. At present, he said, if a man spends 10 minutes in switching, before or during his run, he is paid for the day plus one hour, while under the eight-hour day if he did the switching and also ran 100 miles within eight hours he would receive only one day's pay.

Mr. Lee said that in some cases the overtime would be reduced, but that in most cases it could not be. The incidental switching would not be required unless it was necessary, and in 99 cases out of 100 it would run into overtime and the pay of the crews would be increased. Some of these arbitraries, he said, seem perfectly proper under the present basis of pay, but would become unreasonable under the higher basis proposed.

Mr. Garretson said that the arbitraries had been put in by the men as correctives to force the roads to put the switching work on yard crews instead of road crews.

"With that interpretation of your 'yardstick,'" he said, "I don't see any good purpose in going further with this conference, because there isn't a man we represent that would accept any conclusion based on the abolition of these arbitraries."

"Then there is no necessity for our burdening the record with the detailed answers to your questions," said Mr. Lee.

Mr. Garretson said he would be glad to have them in the record if the railroads cared to put them in, as they would be useful in "going back to the men." It was then decided to adjourn till 2 o'clock, to give the committee an opportunity to decide whether to put the answers in.

W. S. Stone, grand chief engineer of the Brotherhood of Locomotive Engineers, insisted that the railroad proposition means "a service period, pure and simple." "I don't understand it so for a minute," said Mr. Lee.

Timothy Shea, assistant president of the Firemen's Brotherhood, said that after the last western arbitration some roads had eliminated arbitraries and that he knew of an engineer whose earnings for a month had been reduced thereby by $65 and a fireman whose pay had been reduced $45. Mr. Stone argued that if a man runs 100 miles he has earned a

day's pay and that if he is required to do any switching he should receive extra pay for it.

At the afternoon session Mr. Lee announced that the committee had no desire to put the answers to the questions into the record if the other side considered the "yardstick" a sufficient answer, but Mr. Garretson asked that they be read, saying that the brotherhods considered the railroads' reply as the equivalent of a rejection of the demands and that they would reject the railroads' proposition even if the roads would accept theirs. "It becomes an utterly undesirable proposition from our standpoint," he said, but he wished to have the answers read in order to bring out the railroad position more definitely.

Mr. Lee then read the replies to the questions. The following examples illustrate the nature of the questions and of the railroad position as to the elimination of the arbitraries:

1.—Chicago Great Western (Engineers)—Article 3, Section 1.—"Whenever engineers are required to perform any switching service, either before the beginning or after the ending of the trip, they will be paid extra at the rate of 10 miles per hour."

Question.—Man switches 3 hours before leaving terminal, runs 100 miles in 7 hours, total time on duty 10 hours. How will he be paid under paragraph "A"?

Answer.—100 miles and 2 hours overtime.

2.—Missouri Pacific (Engineers and Firemen)—Article 31.—"Engineers and firemen required to do switching at terminal or division points ahead of leaving time or after arrival, shall be paid overtime rates per hour for all such work."

Question.—Man called to leave at 7:00 a. m., leaves at 7:00 a. m., and runs 100 miles in seven hours. Switches three hours after arrival at final terminal—total time on duty 10 hours. What will he be paid for the trip under your proposition?

Answer.—100 miles, one hour pro rata and two hours overtime.

7.—El Paso & Southwestern.—"Engineers will receive 12½ miles per hour at classification rates for bedding cars, loading or unloading, or waiting for stock between terminals, first 30 minutes to constitute an hour, hour for hour thereafter." Road on 12½ miles per hour speed basis.

Question.—Man leaves terminal 8 a. m., stops at intermediate point and loads or unloads stock for two hours, runs 100 miles, arrives at terminal 4 p. m., total time on duty 8 hours. Now paid 100 miles and two hours additional for loading stock. What would he be paid under "A"?

Answer.—100 miles.

11.—Question.—A crew runs 150 miles in ten hours. After arrival at terminal, delayed two hours before finally released. Road has final terminal delay rule. Now receives 150 miles and two hours final terminal delay. Total time 12 hours. How would they be compensated under the railroads' proposition?

Answer.—150 miles plus allowance under final terminal delay rule—pro rata.

23.—C. M. & St. P.—Article 9, par. (b).—"When engineers in through freight service are stopped at intermediate points to do station switching or are used in work train or helper service, they shall be paid for such extra service in excess of mileage or hours made. For each six minutes one mile will be allowed, according to class of engine."

Question.—Does Article "A" of company proposition contemplate the negotiation of a new rule to supersede this in case the basis of the day's pay is changed?

Answer.—Yes.

24.—Question.—An engine or train crew is held out of service for investigation and another crew sent out on the run and at investigation are found blameless. Does "A" apply and would companies refuse to pay both crews?

Answer.—No.

28.—Crew leaves on short turn-around run, returns to terminal in 4 hours. Total 30 miles round trip.

Question.—Would you, under either "A" or "C"—presumably "A"—assert the right to run that man straight on through the terminal with the train he had picked up, or would he be released under the 10 hours or less, or 8 hours or less, clause? Or, if he was the only crew and next out, when he came into that terminal and was called to go on with the work as any man would be called, how would the two trips be paid—the short turn-around, and the long run out of the terminal? Now paid a minimum day for each.

Answer.—Paid continuously.

31.—A brakeman makes a short turn-around run, total of 40 miles in 5 hours. Is released. Allowance now is one day. One hour thereafter he is called, being an extra conductor, to run a train 100 miles from that terminal, making such trip without overtime being earned.

Question.—Under "A" or "C," what would he be allowed?

Answer.—If brakeman has been relieved on first assignment—day as brakeman and day as conductor.

33.—Oregon Short Line—Yard ruling by general superintendent.—"Yard crews required to perform service outside of yard limits will be paid for actual time in addition to all other time made on that day."

Question.—Yard crew loads stock outside yard limits for four hours. Receives under this rule, one day of 10 hours in yard service and four hours loading stock, total 14 hours.

Answer.—The memorandum covering this question shows crew worked 6 hours in yard and 4 hours loading stock outside of yard limits.

Article "C" applies—would be paid 6 hours at yard rate—two hours at road rates, two hours overtime at rate for service in which then engaged.

46.—Wabash Railroad.—"Crews required to run for coal or water will receive actual miles made in addition to mileage made on trip."

Question.—Crew on 80-mile division makes 15 miles running for water and makes trip over division in 8 hours. They now receive 115 miles. What does paragraph "A" contemplate?

Answer.—Minimum day.

49.—C. T. H. & S. E. (Four organizations)—Rule reads: "When road crews are required to switch in yard, and a yard crew is laying up at that point to rest up, the yard crew will be paid actual time that is consumed in switching by the road crew, if the yard crew is called for service on that day. If not used on that day, they will be paid a full day."

Question.—How would this yard crew be paid under "A"?

Answer.—Yard crews would not be paid for service which they do not perform.

51.—Question.—What effect would "A" have upon the articles in the several schedules for what are known as "no-call" days for helper and work train service crews who are paid every day whether used or not?

Answer.—Such rules would not be affected, except that the companies would reserve the right to use men in other service.

55.—Question.—Paragraph "B" reads: "The same classification for the purpose of compensation to be applied to all members of the train and engine crew." Now for example, we have on the Pennsylvania Lines East probably 500 runs where the train crew is paid the yard rate because it is higher, where the engine crew is paid road rates—what effect would paragraph "B" have?

Answer.—The actual service performed will determine the classification.

56.—Question.—On many roads the crew of work trains within certain limits around these large terminals are manned by yard train crews, paid the yard rate, while engine crew is paid road rate. What effect would "B" have?

Answer.—Work train work will be paid work train rates wherever performed.

89.—Would your interpretation of "A," "B," or "C," in any way affect monthly guarantees?

Answer.—Monthly guarantees are eliminated by our proposition.

The reading and discussion of the replies to these questions occupied the remainder of the session on Monday, all of Tuesday's session and was continued on Wednesday.

At the Tuesday morning session W. G. Lee, president of the Brotherhood of Railroad Trainmen, appeared at the conference for the first time and expressed surprise because the railroad proposition was being considered, saying that the brotherhoods' demands contemplated no change whatever in the present schedules except the change in the speed basis from 10 to 12½ miles an hour in train service, the eight-hour day in yard service and the provision for time and one-half for overtime. No other changes would be accepted with his consent, he said.

At the close of the Tuesday session H. A. Wheeler, chairman of the committee appointed by the Chamber of Commerce of the United States to report on the wage controversy, addressed the meeting at his own request, and urged both parties to the negotiations to agree to refer the entire question to the Interstate Commerce Commission. He announced that the referendum taken by the membership of the Chamber of Commerce had resulted in a vote of 981¼ to 29¾ in favor of requesting Congress to ask the Interstate Commerce Commission to make a thorough investigation, with reference not only to the demands of the train employees, but also to the wages of all classes of railway employees.

Mr. Wheeler said that his committee had not been able to secure the information necessary to enable it to reach a decision as to the merits of the controversy, that it had been unable to get a meeting with the officers of the brotherhoods to discuss their standpoint, and that it had reached the conclusion that the commission was the only proper body to investigate the entire railway wage situation. He said that there is already a discrepancy between the wages of the train employees and other employees which ought not to be increased and that would be increased by the granting of the trainmen's demands and that the commission could recommend that wages be increased, if necessary, not only for the trainmen, but also for the other employees. If the commission should recommend such increases he thought the public would be willing to pay for the betterment of the condition of the railway employees.

To show that the referendum had been participated in by all classes of commercial organizations, he said that of the 602 organizations that are members of the Chamber of Commerce 365 had voted, and that out of a possible vote of 1,400, 1,016 votes had been cast. Out of 80 of the larger organiza-

tions, those having 5 votes, 65 had voted, and out of 522 of the organizations having less than 5 votes, 300 had participated. He also read a list of the organizations that had voted against the proposal to submit the question to the Interstate Commerce Commission, which included the Investment Bankers' Association of America, several large trade organizations, and several small chambers of commerce.

Mr. Wheeler expressed the hope that before the conference closed some agreement might be reached which would not require a strike vote, and he hoped that both sides could accept the proposal for submission of the question to the commission. He also appealed to the train employees to be generous enough not to attempt to confine the benefits of increased wages and betterment of conditions to one-fifth of the railway employees, but to take into consideration the interests of all.

Mr. Wheeler's remarks were accepted without discussion. Elisha Lee thanked him on behalf of both parties. The brotherhood leaders had appeared reluctant to hear him when the subject was raised at the previous session by the receipt of a letter from Mr. Wheeler asking the privilege of addressing the meeting. Mr. Stone said that the results of the referendum were a "foregone conclusion." Mr. Shea said that the chamber represented "big business," and Mr. Garretson said that he was perfectly willing to hear Mr. Wheeler, but suggested that it be at the close of the session and not to be considered a part of the record.

The reading and discussion of the railroads' replies to the questions was continued on Wednesday.

A break seemed imminent just before the close of the session when W. G. Lee, president of the trainmen's organization, interrupted, saying: "We are talking here as if both sides had agreed to accept the other's proposition. Let's get an understanding. Haven't we had enough of these questions? Can you in any way accept 35 (the form number given to the brotherhoods' demands) if we accept a, b and c (the railroad proposals)? If you are going to take away any of these rules there isn't any use in talking further. I think you are just as positive that you won't accept our proposition as we are that we won't accept anything that cancels these rules that have been built up."

Elisha Lee replied that neither side had accepted either proposition; that that point had not yet been reached, because he understood that the brotherhoods desired the answers to the questions. After some discussion Mr. Garretson said he thought that, as the brotherhoods had asked the questions, they ought to have the answers. The answering of the questions was then continued. Most of those discussed on Wednesday had to do with the application of the railroads' proposal (c) that crews used in more than one class of service during a day would be paid proportionate rates for each class of service. In many cases they are now paid a minimum day for each class of service. In one case cited, a man ran 50 miles in four hours in passenger service on a short turnaround run, 50 miles in freight service on a similar run in four hours, and then worked four hours in work train service, for which he was paid three days' pay for 12 hours.

At the conclusion of the reading of the replies Mr. Garretson said: "We have now received the information as to how your proposition would apply, and are ready to ask you for a declaration in terms as to whether you will accept our proposition as modified by yours."

"Are you prepared to make that offer?" asked Elisha Lee. "Even if we did you couldn't accept."

"If you made that proposition we could," replied Mr. Garretson, "but we wouldn't. No man on this side of the table would accept our proposition as modified by yours."

"This is a serious question for all of us," said Mr. Lee. "It seems to me we cannot break until we are definitely prepared to say to each other that we are done. We will adjourn until to-morrow and then tell you how we stand."

ECONOMY IN THE USE OF MOTOR TRUCKS*

At the piers of the Chicago & South Haven Steamship Company, South Haven, Mich., the Fruit Belt Auto Truck Express has a fleet of motor trucks engaged in collecting shipments of fruit direct from the farmers within a radius of 15 miles around South Haven. They deliver to the steamship pier where shipments are sorted on the docks according to the consignees and a bulk receipt is taken for all the fruit for each consignee, greatly facilitating delivery at the other end. By this method the farmer is saved the inconvenience of hauling to a terminal and in addition has his fruit transferred in the cool of night so that the produce reaches the market in Chicago early in the morning in good condition. For the steamship company this system opens up new business that previously it was unable to get, and it reduces expenses, as the consignments come to the boats in bulk instead of in small quantities from each individual shipper.

The Bush Line, of Wilmington, Del., which runs freight steamers between Philadelphia and Wilmington, maintains a collection and delivery service by means of motor trucks. These are proving their efficiency on short hauls; for although none of the hauls are over three miles, the trucks are averaging 35 to 40 miles a day, as against 12 to 15 miles for a two-horse team. These trucks are owned and operated by the company that owns the piers and everything is done to make them as efficient as possible. The business houses that are served are saved a great deal of time as the trucks cover a route in less than half the time that horses take. The Bush Line finds that on the item of overtime labor alone the cars are effecting a big saving, for the trucks get to the pier in the evenings from a half to three quarters of an hour earlier than the horse-drawn wagons. Overtime is paid for all dock work after 6 o'clock.

At the Cunard pier, New York City, six "electric stevedores" handling macaroni in boxes did work in nine hours that would have required 24 hand trucks. The cost of labor with electric vehicles was $21, while at current longshoremen's rates it would have cost for labor $87.50 if hand trucks had been relied upon. In handling grapes in barrels at the same dock, two industrial trucks did the work of 21 hand trucks. In handling mackerel in barrels, two electric industrial trucks did the work of 19 hand trucks. In handling casks of wine, seven electrics with thirteen men did the work of 36 men rolling the casks from one man to another. Under the method of hand truck operation, the cost per ton of handling freight at railroad terminals and steamship piers is twenty-five cents, while the cost per ton for performing the same work with electric industrial trucks, is but 10.3 cents.

As the use of the "electric stevedore" increases and other modern methods and appliances are installed, freight sheds and docks may find it desirable to operate on a full or partial 24-hour schedule. In cases where the limited ground space available in city terminals prevents the installation of mechanical carriers, the remedy which appears most feasible to the writer is the establishing of large outer platforms or warehouses where all outbound package freight could be assembled and consolidated, and where the floor movement would be performed by the electric industrial trucks. The co-ordination of the railroad and highway movement of merchandise and a collaboration of the railroads and teaming interests is highly desirable.

ELECTRIFICATION AT MELBOURNE.—The overhead construction for the electrification of the Melbourne (Victoria) railways has been commenced. There is great delay in the delivery of the switchboard gear, owing to the contractor being engaged on munitions work. The consulting engineers are hoping to have the contract relet in the United States.

*From a paper by A. Jackson Marshall, Secretary of the Electric Vehicle Association of America, New York City.

General News Department

The Lehigh Valley has created the new position of supervisor of stations, and R. M. Johnson, hitherto yardmaster at Jersey City, has been appointed to the position. His office will be at South Bethlehem, Pa., and he will report direct to the general manager.

According to a statement issued by Thomas W. Hulme, general secretary of the Presidents' Conference Committee on the Federal Valuation of the Railroads, 64,793 miles of line of road and track have been inspected and inventoried up to May 31, 1916. The federal parties had also covered the bridges on 40,112 miles of line and had inspected "adjacent similar lands" on 29,495 miles of line previous to this date.

In a fire at the Pennsylvania Railroad piers at Canton, Baltimore, Md., on the afternoon of June 13, grain elevator No. 3 was destroyed together with much other property, and a number of employees and other persons, said to be ten or more, were killed. Over 30 other persons were injured by burns and falls. The property loss is estimated at $2,000,000. The ore pier and many freight cars were destroyed and several vessels lying at the piers were badly damaged.

The Boston & Maine has offered an increase of 5 per cent in wages to such of its employees outside of the "Big Four" brotherhoods as have not had advances recently, and are not now paid notably more than the prevailing wages for similar work in eastern New England. The increase will add about $800,000 a year to the Boston & Maine payrolls. It has been accepted by several of the unions that had taken strike votes to enforce recent demands upon the road. President Hustis says that if the company were to pay all the demands that have been made upon it by the unions, inclusive of the "Big Four" demands, it would increase the road's payroll by $5,000,000 a year.

The most beautiful station on each district of the Intercolonial Railway—which, for this purpose, includes the Prince Edward Island Railway—will this year be awarded a prize of $25, and there will be a second prize of $10. The word "beautiful" as here used refers to the grounds around the station and to the results of the work done by the agent in sowing flower seeds, securing plants and taking care generally. A prize of $10 will be paid also to the best engine house and one to the best section house on each district, the second prizes to locomotive foremen and section foremen being $5. The preparation of lawns and the care of the grounds generally, including water supply, will be supervised by the maintenance department; but the securing of plants and the management of plants and flowers, etc., will be under the supervision of the floral department, at the head of which is J. E. Long, safety engineer.

A Correction

In our issue of May 26 in the report of the International Railway Fuel Associations' proceedings, a paper on fuel stations was published in which we described two designs of coal measuring devices. The description of these designs were headed design A and design B. Inadvertently the drawing described as design A was put in the column of reading matter pertaining to design B, and the drawing showing design B was put in reading matter pertaining to design A.

Investigating Working Conditions of Railroad Employees

The Russell Sage Foundation has made a report on "Industrial Conditions in Springfield, Illinois," in which, under the head of "Hours of Labor," it is said that "employment on the railroad offers an illustration of a combination of long hours with work requiring strained attention, and with fatal results waiting as a penalty for relaxed watchfulness. Practically all of the 1,000 men connected with the various railroads running into Springfield were working a ten-hour day or night as the case might be. Irregular hours and the unbroken periods of work for week after week and month after month, without a regular day of rest, are other arduous features of railway employment. One man, for instance, a railroad employee for the last nineteen years, and a switchman at the time interviewed, was working from 7 p. m. until 6, 7 or 8 o'clock, and sometimes even later the following morning. When going to work he never knew whether he would be on duty ten, twelve or fourteen hours. Seven-day labor, moreover, is the rule in the railroad business. In the hours of labor of railway employees the public has a special concern. Railways are public conveyances, and if hours are so long as to cause undue fatigue among the workers, serious mishaps, involving not only the workers, but the traveling public, may result."

Shower Baths for Freight Cars

The Southern Pacific is installing shower baths for freight cars at Los Angeles and San Francisco for the purpose of testing the cars for leaky roofs.

A Good Record of Trains on Time

The Union Pacific has furnished a record of some of its through trains during April last, which shows a very satisfactory record of trains on time. The Overland Limited arrived in San Francisco on time every day but one, when it was 40 minutes late. It arrived in Chicago on time every day. The San Francisco Limited was on time 29 days. The Los Angeles Limited arrived in Chicago on time 28 days, and was late on 2 days, 6 minutes and 20 minutes respectively. The Colorado Special arrived at Denver on time 28 days. It arrived in Chicago on time every day but one, when it was 28 minutes late. The Colorado Express arrived in Denver late 2 days. The Pacific Limited arrived in Los Angeles on time every day but one. The Portland & Puget Sound Express arrived at Portland every day on time. The distances covered by these trains vary from 1,052 miles to 2,302 miles.

No Railroad Negligence on Grade Crossings

The Railroad Commission of California, in a report of accident investigations covering the period from July 1, 1914, to June 30, 1915, states that the investigation of the accidents in which automobiles or motor-driven vehicles have been involved at highway grade crossings since such investigations have been instituted by the commission, and covering a period of over 2½ years, has not revealed a single instance where a fatality has occurred due to negligence on the part of the railroad. This report is of especial interest to the Southern Pacific Lines, with which the state of California is gridironed. A great many fatal accidents have occurred, all of which have been investigated and reported upon by boards of inquiry composed of Southern Pacific officers and representatives of the public, and it is most gratifying to officers of the road to know that the findings of the boards have been confirmed in bulk by the report of the commission.

Increased Cost of Material and Supplies

W. C. Nixon, receiver and chief operating officer of the St. Louis & San Francisco, has issued under date of June 1, a circular showing the increased cost of material and supplies. The circular of the same road dated March 13 showed that the prices on materials and supplies had increased 53.6 per cent since last year. At the present time the prices of these same materials and supplies (not including fuel, rails and ties) have advanced to 63.7 per cent, an addition of 10.1 per cent since the March circular. The opinion is advanced that these prices will continue, making it all the more obvious that every possible economy in the use of materials and supplies should be exercised. The purchases of the St. Louis & San Francisco last year of miscellaneous material amounted to $3,314,753. This same ma-

terial at the market prices on March 15, 1916, would amount to $5,091,460, and at the prices current on June 1 would amount to $5,426,251. The increase in the cost of stationery alone is appreciable. Last year this item amounted to $262,917. The same amount purchased in March this year would have cost $355,000, and now would cost $426,715, or an increase in the price over 1915 of $163,797. Attached to the circular is a list showing in detail certain items in which the increases range from 10 per cent to 80 per cent, and a supplemental list in which the increases are from 80 per cent to 700 per cent, the latter item being represented by high speed tool steel. The items on which the larger increases have taken place are nearly all of the higher classes of metals.

Long Island Grade Crossing Campaign

The Long Island Railroad, in its determined effort to promote safety at grade crossings, is conducting an extensive advertising campaign in the local newspapers; 24 advertisements in 100 newspapers. In the twelve months ending with December last, 82 automobiles ploughed through crossing gates; two lives were lost at grade crossings as the result of reckless driving; 22 motorists raced heedlessly across tracks to beat trains, at crossings where there are no gates, but where there are bells or watchmen; 13 automobiles were run against the sides of trains at grade crossings, or were driven on to the tracks directly in front of on-rushing trains with resulting collisions, and 18 motorists deliberateley ran into and knocked down 18 traffic signs and a number of lanterns which the city and railroad authorities had placed at grade crossings for the safety of these offenders. The results of the company's campaign last year were highly gratifying; but, says the general manager, "do not the facts above disclosed constitute a most disgraceful performance on the part of automobilists? Isn't it time that motorists began to give more thought to saving lives than saving a few seconds? Are we asking too much when we ask automobilists to stop, look and listen before crossing the tracks?"

At Jamaica, N. Y., on June 7, the Long Island Railroad prosecuted the driver of a baker's wagon for running into and breaking the gate at a highway crossing and secured his conviction; and he was fined $25. This is the second prosecution of this kind, the previous case having been against Mrs. Martha Pease, said to be a "society woman." The baker was warned by the magistrate that on convictions in future cases imprisonment might be the penalty.

Dead Man's Button and Auxiliary Lookout

The New York State Public Service Commission, Second district, following a complaint by the Brotherhood of Locomotive Firemen, has issued an order regulating the use of the "dead man's button" on the electric trains of the Erie road between Rochester and Avon, 19 miles. The order requires that when electric cars are operated as the motive power for non-electric cars the dead man's button shall be so arranged by locks and seals that it cannot be readily put out of use; and that when trains are thus operated they must be so made up as to enable the train men to get from the coaches into the motor cars while the train is in motion. If it is not possible to make up trains in this manner, the Commission orders that a spare trainman ride in the motor car for the sole purpose of assisting the motorman in emergency.

The brotherhood, through Thomas E. Ryan, chairman of its legislative board, complained that the dead man's button, designed to shut off the power and apply the brakes whenever the motorman takes the pressure of his hand from the controller, had been so tampered with that the air valve could be removed, thus permitting the motorman to ride without holding the controller; and the provision for the automatic stopping of the train in case anything should happen to the motorman was thus nullified. In trains with electric cars coupled on to steam trains, baggage cars without end doors, or baggage cars so piled with goods that the doors could not be used, were frequently placed between the motor cars and the rest of the train, so that the motorman was alone in his cab and beyond reach of aid in case anything should happen to him. The Commission now issues its order to meet this condition, and believes that operation is made reasonably safe. The only motorman examined by the Commission testified that the presence of an extra motorman in the cab with him would be more a source of danger than an aid to safety.

Freight Congestion on the New Haven

The circular recently issued by the New York, New Haven & Hartford to shippers and receivers of freight, briefly noticed in the *Railway Age Gazette,* June 2, page 1196, says that consignees have not unloaded cars as promptly this spring as they did last fall. During March and April the average number of cars unloaded daily was about 4,200 or 4,300, whereas in November and December, 1915, the average daily unloading was 5,500. In placing cars for delivery, on the other hand, the railroad company increased its efficiency, the average number in November and December being from 10,000 to 11,000 daily, while in March and April it rose to 12,000, and sometimes 13,000. Continuing, the circular says:

"It is the desire of the management to remove all embargoes and avoid further embargoes. The date upon which all embargoes can be released will depend upon the co-operation the company receives from its patrons. Shippers and consignees can increase the amount of transportation the road can furnish. As a chain is no stronger than its weakest link, so is the capacity of a railway no greater than the capacity of its terminal facilities. This in turn is limited by the facilities of consignees and their ability to load and unload cars placed for them. While the capacity of the New Haven has been proved sufficient for an average day's delivery of 5,500 cars, the average daily unloading for several months has been considerably less. Interstate Commerce Commissioner E. E. Clark, chairman of the embargo committee, recently stated that the capacity of the road had been decreased 50 per cent by reason of slow unloading.

"Last fall when shipments of coal were ordered forward far in excess of consignees' ability to unload, these cars were stored on tracks which should have been kept for receiving, classifying and forwarding trains, thus making it more difficult to move freight of greater importance. When unloading slackened, hundreds of cars were held at destination owing to the unloading tracks being occupied, thereby blocking the yards; and there were from 2,000 to 4,000 cars set out at intermediate stations, blocking the passing tracks, delaying the movement of trains and increasing the cost of transportation. There were from 10,000 to 15,000 cars delayed on connecting lines. . . . The cost of transportation, including hire of cars, increased enormously, and the company suffered a financial loss, the increases in revenue being offset by much greater increases in expenses.

"The necessity for embargo is always unfortunate. It restricts business, and it cannot always be confined to those who may be delinquent. More or less accumulation and congestion occur before an embargo is placed. The aim should be to make embargoes unnecessary. The remedy for the present situation is continuous co-operation of the railway and the shipper so that the maximum use may be made of each car and each track."

Collision on Manhattan Elevated

On the afternoon of June 8, at a time when a light rain was falling, a rear collision of southbound trains on the elevated line of the Interborough Rapid Transit Company, in Third avenue, a short distance north of 149th street station, resulted in the motorman being fatally injured; and eleven passengers were sufficiently hurt to have their names taken by the police department. The leading train, which was at a standstill, was empty. When a collision of passenger trains occurs on one of the elevated or subway lines in New York City it receives the immediate and undivided attention of a large number of persons. A policeman who was beneath the elevated structure when this collision occurred, at once sent in a fire alarm, and the firemen were on the spot within a very few minutes. (The cars had taken fire.) Three members of the Public Service Commission of the state, whose office is at 120 Broadway, about eight miles from the scene of the wreck, were on the spot as soon as a speedy automobile could carry them there; and very shortly the president of the road, Theodore P. Shonts, and the general manager, Frank Hedley, were there. The coroner of the county seems to have been the first investigator on hand, and, according to

reports, he climbed up to the elevated structure and had begun his inquiries before any person was reported dead. The district attorney of the county (Bronx county) sent detectives to the scene, and, considerably controversy having arisen between the officers of the road and the coroner, the district attorney within a few hours had the grand jury assembled in special session.

The standing train was about a train length in the rear of the station, a preceding train having been found occupying the track at the platform, discharging passengers. The leading car of the moving train was lifted about ten feet and jammed its way for three-quarters of its length along the upper part of the rear car of the standing train. The motorman in charge of the moving train was thrown forward through his front window and on to the floor of the car ahead. This man had a good record. One conjecture as to his failure is that, possibly deceived by the rain or mist, he assumed that the standing train was at the platform instead of several hundred feet short of it; but the facts that he did not leave his box, and that he had not reduced the speed of his train below 15 or 20 miles an hour, indicate that he was not keeping a lookout.

The colliding train ran past a signal, a short distance in the rear of the standing train, connected with which there is a torpedo placer; and, this signal being clear, the coroner caused the arrest of the signalman in the tower nearby; but he (the towerman) could not possibly have been in any way responsible, as the signal in question is not a block signal; it is an interlocked signal for a trailing point junction; and is always left clear for the main line except when a junction movement is to be made. All switches and other equipment were found in good condition, and the whole situation, according to an officer of the road, was precisely as it had been for many years.

The line approaching the point of collision is slightly curved, and the approaching motorman saw or could have seen the standing train for about 1,000 feet.

The report of this collision in the New York Times is 53 inches in length. It includes a statement of an officer of the Interborough that the directors of that company, about six months ago, authorized the installation of automatic block signals and automatic stops on all curves on the elevated railroad; and these fixtures are being put in place as rapidly as possible.

At a recent hearing before the Public Service Commission, General Manager Frank Hedley said that this new signaling on the elevated roads, together with the block signals to be put in on the new third tracks of the elevated lines, which are to be used for express trains, would cost $1,400,000.

The railroad company continues to maintain strenuously its objection to the order of the commission requiring that on the elevated lines, as on the express tracks in the subway, there shall be a complete equipment of automatic block signals and automatic train stops.

MEETINGS AND CONVENTIONS

The following list gives names of secretaries, date of next or regular meetings and places of meeting of those associations which will meet during the next three months. The full list of meetings and conventions is published only in the first issue of the Railway Age Gazette for each month.

American Association of Demurrage Officers.—F. A. Pontious, 455 Grand Central Station, Chicago. Next meeting, June 26, 1916, Boston, Mass.

American Association of Freight Agents.—R. O. Wells, Illinois Central, East St. Louis, Ill. Next meeting, June 20-23, 1916, Cincinnati, O.

American Association of Railroad Superintendents.—E. H. Harman, Room 101, Union Station, St. Louis, Mo. Annual meeting, August 16-18, 1916, Memphis, Tenn.

American Railway Master Mechanics' Association.—J. W. Taylor, 1112 Karpen Bldg., Chicago. Annual meeting, June 19-21, 1916, Atlantic City, N. J.

American Railway Tool Foremen's Association.—Owen D. Kinsey, Illinois Central, Chicago. Annual meeting, August 24-26, 1916, Hotel Sherman, Chicago.

American Society for Testing Materials.—Prof. E. Marburg, University of Pennsylvania, Philadelphia, Pa. Annual meeting, June 27-30, Hotel Traymore, Atlantic City, N. J.

American Society of Civil Engineers.—Chas. Warren Hunt, 220 W. 57th St., New York. Regular meetings, 1st and 3d Wednesday in month, except July and August, 220 W. 57th St., New York.

Association of American Railway Accounting Officers.—E. R. Woodson, Rooms 1116-8 Woodward Bldg., Washington, D. C. Annual meeting, June 28, 1916, Hotel Statler, Detroit, Mich.

Asssociation of Railway Electrical Engineers.—Jos. A. Andreucetti, C. & N. W., Room 411, C. & N. W. Sta., Chicago. Semi-annual meeting, June 16, 1916, Hotel Denis, Atlantic City, N. J.

Association of Railway Telegraph Superintendents.—P. W. Drew, Soo Line, 112 West Adams St., Chicago. Annual meeting, June 20-22, 1916, St. Paul, Minn.

Association of Transportation and Car Accounting Officers.—G. P. Conard, 75 Church St., New York. Next meeting, June 27, 28, Boston, Mass.

Bridge and Building Supply Men's Association.—P. C. Jacobs, H. W. Johns-Manville Co., Chicago. Meetings with American Railway Bridge and Building Association.

Canadian Railway Club.—James Powell, Grand Trunk, P. O. Box 7, St. Lambert (near Montreal), Que. Regular meetings, 2d Tuesday in month, except June, July and August, Windsor Hotel, Montreal, Que.

Canadian Society of Civil Engineers.—Clement H. McLeod, 176 Mansfield St., Montreal, Que. Regular meetings, 1st Thursday in October, November, December, February, March and April. Annual meeting, January, Montreal.

Car Foremen's Association of Chicago.—Aaron Kline, 841 Lawlor Ave., Chicago. Regular meetings, 2d Monday in month, except June, July and August, Hotel La Salle, Chicago.

Central Railway Club.—H. D. Vought, 95 Liberty St., New York. Regular meetings, 2d Friday in January, May, September and November. Annual meeting, 2d Thursday in March, Hotel Statler, Buffalo, N. Y.

Cincinnati Railway Club.—H. Boutet, Chief Interchange Inspector, Cin'ti Rys., 101 Carew Bldg., Cincinnati. Regular meetings, 2d Tuesday, February, May, September and November, Hotel Sinton, Cincinnati.

Engineers' Society of Western Pennsylvania.—Elmer K. Hiles, 2511 Oliver Bldg., Pittsburgh, Pa. Regular meetings, 1st and 3d Tuesday, Pittsburgh, Pa.

General Superintendents' Association of Chicago.—A. M. Hunter, 321 Grand Central Station, Chicago. Regular meetings, Wednesday, preceding 3d Thursday in month. Room 1856, Transportation Bldg., Chicago.

International Railroad Master Blacksmiths' Association.—A. L. Woodworth, C. H. & D., Lima, Ohio. Next meeting, August 15-17, 1916, Hotel Sherman, Chicago.

International Railway General Foremen's Association.—Wm. Hall, 1126 W. Broadway, Winona, Minn. Annual meeting, August 29 to September 1, Hotel Sherman, Chicago.

New England Railroad Club.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Regular meeting, 2d Tuesday in month, except June, July, August and September, Boston.

New York Railroad Club.—Harry D. Vought, 95 Liberty St., New York. Regular meeting, 3d Friday in month, except June, July and August, 29 W. 39th St., New York.

Niagara Frontier Car Men's Association.—E. N. Frankenberger, 623 Brisbane Bldg., Buffalo, N. Y. Meetings, 3d Wednesday in month, New York Telephone Bldg., Buffalo, N. Y.

Peoria Association of Railroad Officers.—M. W. Rotchford, 410 Masonic Temple Bldg., Peoria, Ill. Regular meetings, 3d Thursday in month, Jefferson Hotel, Peoria.

Railroad Club of Kansas City.—Claude Manlove, 1008 Walnut St., Kansas City, Mo. Regular meetings, 3d Saturday in month, Kansas City.

Railway Club of Pittsburgh.—J. B. Anderson, Room 207, P. R. R. Sta., Pittsburgh, Pa. Regular meetings, 4th Friday in month, except June, July and August, Monongahela House, Pittsburgh.

Railway Electrical Supply Manufacturers' Association.—J. Scribner, 1063 Monadnock Block, Chicago. Meetings with Association of Railway Electrical Engineers.

Railway Supply Manufacturers' Association.—J. D. Conway, 2136 Oliver Bldg., Pittsburgh, Pa. Meetings with Master Car Builders' and Master Mechanics' Associations.

Railway Telegraph and Telephone Appliance Association.—G. A. Nelson, 50 Church St., New York. Meetings with Association of Railway Telegraph Superintendents.

Richmond Railroad Club.—F. O. Robinson, C. & O., Richmond, Va. Regular meetings, 2d Monday in month, except June, July and August.

St. Louis Railway Club.—B. W. Frauenthal, Union Station, St. Louis, Mo. Regular meetings, 2d Friday in month, except June, July and August, St. Louis.

Salt Lake Transportation Club.—R. E. Rowland, David Keith Bldg., Salt Lake City, Utah. Regular meetings, 1st Saturday of each month, Salt Lake City.

Signal Appliance Association.—F. W. Edmunds, 3868 Park Ave., New York. Meetings with annual convention Railway Signal Association.

Southern & Southwestern Railway Club.—A. J. Merrill, Grant Bldg., Atlanta, Ga. Regular meetings, 3d Thursday, January, March, May, July, September, November, 10 A. M., Piedmont Hotel, Atlanta.

Toledo Transportation Club.—Harry S. Fox, Toledo, Ohio. Regular meetings, 1st Saturday in month, Boody House, Toledo.

Traffic Club of Chicago.—W. H. Wharton, La Salle Hotel, Chicago.

Traffic Club of Newark.—Roy S. Bushy, Firemen's Bldg., Newark, N. J. Regular meetings, 1st Monday in month, except July and August, The Washington, 559 Broad St., Newark.

Traffic Club of New York.—C. A. Swope, 291 Broadway, New York. Regular meetings, last Tuesday in month, except June, July and August, Waldorf-Astoria Hotel, New York.

Traffic Club of Pittsburgh.—D. L. Wells, Gen'l Agt., Erie R. R., 1924 Oliver Bldg., Pittsburgh, Pa. Meetings, bi-monthly, Pittsburgh.

Traffic Club of St. Louis.—W. S. Crilly, 620 South 7th St., St. Louis, Mo. Annual meeting, December 5, 1916. Noonday meetings, October to May.

Train Despatchers' Association of America.—J. F. Mackie, 7122 Stewart Ave., Chicago. Next convention, June 20, 1916, Toronto, Ont.

Transportation Club of Detroit.—W. R. Hurley, Superintendent's office, N. Y. C. R. R., Detroit, Mich. Meetings monthly, Normandie Hotel, Detroit.

Traveling Engineers' Association.—W. O. Thompson, N. Y. C. R. R., Cleveland, Ohio. Next meeting, September 5-8, 1916, Hotel Sherman, Chicago.

Utah Society of Engineers.—Frank W. Moore, 1111 Newhouse Bldg., Salt Lake City, Utah. Regular meetings, 3d Friday in month, except July and August, Salt Lake City.

Western Canada Railway Club.—L. Kon, Immigration Agent, Grand Trunk Pacific, Winnipeg, Man. Regular meetings, 2d Monday, except June, July and August, Winnipeg.

Western Railway Club.—J. W. Taylor, 1112 Karpen Bldg., Chicago. Regular meetings, 3d Tuesday in month, except June, July and August, Grand Pacific Hotel, Chicago.

Western Society of Engineers.—E. N. Layfield, 1735 Monadnock Block, Chicago. Regular meetings, 1st Monday in month, except January, July and August, Chicago. Extra meetings, except in July and August, generally on other Monday evenings. Annual meeting, 1st Wednesday after 1st Thursday in January, Chicago.

REVENUES AND EXPENSES OF RAILWAYS

MONTH OF APRIL, 1916

Name of road.	Average mileage operated during period.	Operating revenues — Freight.	Operating revenues — Passenger.	Operating revenues — Total (inc. misc.)	Operating expenses — Maintenance of — Way and structures.	Operating expenses — Maintenance of — Equipment.	Operating expenses — Traffic.	Operating expenses — Transportation.	Operating expenses — Miscellaneous.	Operating expenses — General.	Operating expenses — Total.	Net from railway operation.	Railway tax accruals.	Operating income (or loss).	Increase (or decr.) comp. with last year.
Alabama & Vicksburg	143	$99,802	$28,115	$141,148	$18,013	$34,824	$3,359	$49,166	$2,056	$5,383	$112,802	$28,346	$8,535	$19,811	$15,484
Alabama Great Southern	309	352,539	89,258	476,545	50,066	98,073	13,014	142,751	2,972	10,483	317,361	159,184	17,669	141,515	50,574
Ann Arbor	294	169,792	40,500	223,192	14,887	29,110	5,657	79,561	295	11,793	141,303	81,890	15,970	65,919	22,570
Arizona Eastern	378	269,328	42,421	326,935	55,354	32,901	2,482	58,563	989	15,052	164,894	162,040	16,991	145,047	82,748
Atchison, Topeka & Santa Fe	8,620	6,672,147	1,983,404	9,391,482	1,224,854	1,695,301	179,121	2,617,514	....	183,126	5,882,672	3,508,809	463,548	3,044,192	413,922
Atlanta & West Point	93	65,612	38,749	119,334	13,027	19,095	6,499	34,939	1,987	4,934	80,482	38,852	6,564	31,731	5,419
Atlanta, Birmingham & Atlantic	640	191,244	38,375	248,284	44,695	48,505	14,049	91,844	28	8,669	207,790	40,494	13,100	27,394	....
Atlantic & St. Lawrence	166	206,174	20,647	240,896	18,849	24,423	4,489	85,483	....	4,397	137,643	103,252	11,505	91,747	73,628
Atlantic City	170	77,789	87,005	173,793	24,940	24,526	4,554	86,526	104	1,603	142,252	31,541	10,000	21,536	27,259
Atlantic Coast Line	4,704	2,189,581	791,164	3,265,144	349,376	455,782	58,198	1,000,725	13,772	70,902	1,945,567	1,319,577	163,000	1,155,080	201,061
Baltimore & Ohio	4,535	7,171,086	1,184,844	9,042,069	1,494,514	2,046,748	167,947	3,144,709	66,257	210,841	7,128,136	1,913,933	322,007	1,589,923	—680,826
Baltimore & Ohio Chicago Terminal	79	....	462	158,321	18,694	20,473	918	75,123	1,243	12,260	127,492	30,830	22,689	8,082	—10,758
Baltimore, Chesapeake & Atlantic	87	45,832	23,473	73,607	6,665	15,524	1,318	41,239	....	2,527	67,274	6,333	2,243	4,060	....
Bangor & Aroostook	631	309,784	53,198	380,382	45,703	46,123	2,960	87,108	3,040	12,228	197,164	183,217	14,150	169,053	41,363
Belt Ry. Co. of Chicago	31	....	....	247,558	19,421	35,339	1,432	100,264	....	6,279	162,735	84,823	15,207	69,616	—25,214
Bessemer & Lake Erie	205	470,937	28,426	517,300	87,157	184,436	8,263	167,073	....	13,777	442,496	74,804	22,003	52,801	—77,091
Bingham & Garfield	26	186,523	2,880	190,042	16,737	23,996	1,057	19,301	50	2,954	64,098	125,944	6,367	119,576	45,125
Boston & Maine	2,302	2,808,031	1,179,327	4,447,447	468,687	519,385	30,725	1,858,040	15,798	96,178	2,988,814	1,458,632	168,808	1,289,824	539,022
Buffalo & Susquehanna R. R. Corp.	253	111,011	7,226	120,762	21,887	35,549	1,216	35,898	....	5,170	99,720	21,042	2,600	18,441	8,384
Buffalo, Rochester & Pittsburgh	586	763,630	96,879	897,675	92,222	196,803	11,972	322,397	1,290	22,174	646,859	250,816	20,000	230,788	80,818
Canadian Pacific Lines in Maine	233	264,288	19,321	296,748	15,192	31,843	5,768	107,263	....	3,591	163,657	133,091	....	133,091	88,313
Carolina, Clinchfield & Ohio	283	238,644	18,828	263,793	30,160	38,393	15,840	51,868	....	11,253	146,546	117,247	9,500	107,725	43,063
Carolina, Clinchfield & Ohio of S. C.	18	14,137	1,254	15,793	1,725	107	2,227	2,724	....	781	7,540	8,253	500	7,753	2,092
Central of Georgia	1,924	659,204	229,102	990,531	152,714	188,034	34,880	308,507	1,931	38,951	723,218	267,313	52,427	214,729	—39,546
Central of New Jersey	681	2,027,846	473,684	2,705,345	247,349	354,991	27,661	969,546	13,232	57,375	1,669,934	1,035,411	139,594	895,817	8,635
Central New England	304	391,036	30,901	441,068	42,038	37,401	1,346	131,863	....	4,518	217,147	223,921	17,800	206,115	—2,616
Central Vermont	411	292,419	62,679	387,174	42,934	52,997	7,406	178,304	2,802	12,287	296,730	90,444	15,040	74,803	13,643
Charleston & Western Carolina	342	142,835	24,584	177,571	25,151	18,090	3,901	54,203	....	5,297	106,644	70.926	5,000	65,926	9,946
Chesapeake & Ohio Lines	2,374	3,175,419	496,485	3,927,523	499,993	988,696	33,386	1,156,545	24,974	84,641	2,806,019	1,121,504	137,000	974,598	—81,939
Chicago & Alton	1,052	856,799	291,398	1,252,347	140,294	283,867	33,977	434,048	8,591	32.461	933,175	319,171	51,879	266,539	228,804
Chicago & Eastern Illinois	1,136	831,351	219,457	1,154,189	226,457	284,370	26,031	411,655	8,199	35,815	991,243	162,946	61,507	101,042	210,997
Chicago & Erie	269	607,856	44,283	703,246	63,956	76,609	18,923	277,363	2,069	15,043	453,899	249,346	22,230	227,116	133,534
Chicago & North Western	8,108	4,956,914	1,607,712	7,360,750	1,043,816	1,245,794	106,207	2,701,640	58,872	161,648	5,308,623	2,052,127	405,000	1,646,864	344,179
Chicago, Burlington & Quincy	9,369	5,710,296	1,513,427	8,060,057	1,379,045	1,279,947	126,714	2,396,899	92,888	166,090	5,441,583	2,618,474	369,385	2,249,089	1,183,758
Chicago Great Western	1,496	829,306	245,636	1,179,305	189,225	212,838	44,595	433,392	8,715	32,932	920,006	259,299	45,744	212,533	116,962
Chicago, Indianapolis & Louisville	622	437,844	159,565	648,660	59,809	110,948	21,732	215,478	362	16,518	424,519	224,141	36,825	185,546	23,233
Chicago Junction	13	....	....	197,679	21,485	18,804	1,416	115,160	....	6,126	162,992	34,687	2,336	32,351	10,691
Chicago, Milwaukee & St. Paul	10,210	6,474,829	1,451,072	8,748,558	1,240,497	1,360,907	175,279	3,259,318	58,016	158,610	6,196,748	2,551,810	419,080	2,128,578	574,275
Chicago, Peoria & St. Louis	255	107,625	21,289	136,751	14,223	26,795	5,540	57,408	....	5.648	109,615	27,135	6,000	21,135	18,924
Chicago, Rock Island & Gulf	477	175,951	46,117	242,168	45,693	37,288	9,536	86,699	989	8,914	189,118	53,050	10,000	42,975	22,320
Chicago, Rock Island & Pacific	7,559	4,041,034	1,206,486	5,761,977	707,575	974,617	130,044	2,048,618	38,657	156,190	4,039,954	1,722,023	294,766	1,426,801	586,397
Chicago, St. Paul, Minn. & Omaha	1,753	1,143,942	394,383	1,660,739	130,809	207,887	26,759	602,221	14,856	40,191	1,022,090	638,649	84,367	553,021	206,975
Chicago, Terre Haute & Southeastern	372	122,221	16,377	143,442	37,239	68,990	3,623	50,529	793	8,306	169,423	—25,980	13,383	—39,364	—66,707
Cincinnati, Hamilton & Dayton	622	568,885	83,800	733,867	146,334	168,576	14,141	264,170	3,316	17,828	613,928	119,939	29,292	89,992	101,882
Cincinnati, Indianapolis & Western	322	124,292	37,267	177,090	27,681	22,944	6,211	77,787	478	7,176	141,759	35,331	9,656	25,675	....
Cincinnati, New Orleans & Texas Pacific	337	745,759	133,571	940,963	95,100	218,678	25,571	272,064	9,579	18,705	639,696	301.267	32,000	269,265	29,830
Cincinnati Northern	246	122,697	13,948	142,605	23,691	28,792	3,065	48,043	....	3,090	106,681	35,924	6,000	29,924	5,256
Cleveland, Cincinnati, Chic. & St. Louis.	2,385	2,486,036	693,936	3,533,145	359,491	724,904	83,419	1,232,243	17,950	71,000	2,484,415	1,048,731	135,000	913,136	332,352
Colorado Midland	338	90,788	8,595	109,682	19,164	29,045	6,908	46,699	788	5,320	107,923	1,759	6,800	—5,041	10,220
Colorado & Southern	1,102	506,961	98,850	653,430	89,984	135,979	11,984	180,971	3,425	20,494	442,839	210,591	35,000	175,566	81,731
Cripple Creek & Colorado Springs	87	100,152	12,369	114,323	9,402	14,918	2,708	24,178	....	3,556	54,761	59,562	8,636	50,926	....
Cumberland Valley	164	246,857	52,805	312,502	19,656	25,625	4,465	80,294	1,091	8,103	138,260	174,242	5,960	168,282	93,614
Delaware & Hudson Co.—R. R. Dept.	885	1,825,204	215,047	2,184,844	188,776	389,087	26,705	809,201	17,231	73,876	1,504,140	680,704	58,650	622,052	—220,292
Delaware, Lackawanna & Western	955	2,623,908	676,957	3,720,735	328,649	559,677	77,649	1,304,411	30,346	75,961	2,376,320	1,344,415	202,500	1,141,155	—169,361
Denver & Rio Grande	2,566	1,488,596	304,524	1,918,001	161,694	327,684	40,155	483,626	22,727	51,027	1,086,912	831,089	90,000	741,074	226,993
Denver & Salt Lake	255	74,654	22,442	104,388	14,602	25,936	1,601	34,003	....	5,768	81,911	22,477	7,008	15,469	—6,618
Detroit & Mackinac	393	81,935	26.204	114,174	12,157	20,105	2,903	31,790	....	2,455	69,410	44,763	8,003	36,760	3,921
Detroit & Toledo Shore Line	81	139,890	....	141,012	10,172	9,085	1,498	40,361	....	2,820	63,936	77,076	10,870	66,206	13,069
Detroit, Grand Haven & Milwaukee	190	213,000	36,000	279,930	32,139	42,028	4,636	126,636	565	4,470	210,475	69,454	3,770	65,670	43,753
Detroit, Toledo & Ironton	441	156,403	11,925	180,370	20,140	23,770	4,531	85,740	....	6,693	140,874	39,496	6,000	33,496	21,302
Duluth & Iron Range	288	310,751	22,053	348,948	73,030	88,815	2,061	100,921	2,048	8,578	272,770	76,179	17,328	58,851	652
Duluth, Missabe & Northern	399	467,730	32,261	526,108	110,518	99,386	2,618	124,232	1,220	10,210	348,184	177,924	29,314	148,610	81,194
Duluth, South Shore & Atlantic	628	210,602	69,013	299,967	44,610	37,843	6,782	101,723	3,231	8,144	202,333	97,634	19,000	78,620	59,017
Duluth, Winnipeg & Pacific	187	147,707	20,643	172,377	17,387	16,945	1,897	49,584	645	5,281	91,738	80,639	8,619	72,020	56,607
El Paso & Southwestern Co.	1,027	776,319	142,863	964,898	95,044	114,418	17,302	241,382	5,691	25,282	499,120	465,778	37,329	428,447	203,270
Elgin, Joliet & Eastern	797	1,130,869	4	1,205,032	110,101	254,897	6,743	339,808	....	19,583	731,020	474,013	34,515	438,818	185,740
Erie	1,987	4,[illegible]86,685	736,539	5,324,647	450,845	1,179,484	88,473	2,034,897	36,065	111,756	3,871,035	1,453,612	194,147	1,258,071	400,598
Florida East Coast	744	604,302	198,228	922,549	73,809	74,043	7,811	194,795	4,863	20,837	374,573	547,573	33,427	514,094	248,628
Fort Worth & Denver City	454	290,318	97,915	412,985	52,616	78,046	6,329	120,597	2,253	15,529	275,373	137,611	15,216	122,395	54,055
Galveston, Harrisburg & San Antonio	1,351	781,236	234,474	1,094,026	212,726	144,315	31,328	398,056	10,593	30,469	823,012	271,014	48,502	221,618	165,216
Galveston Wharf	13	....	....	112,533	1,640	2,147	364	29,516	18,822	368	52,857	59,677	12.000	47,677	—3,959
Georgia	307	183,207	63,366	269,314	26,067	32,910	12,283	107,697	77	7,797	186,803	82,511	4,885	77,623	55,995
Georgia, Southern & Florida	395	119,071	44,414	191,668	20,058	38,859	6,852	74,523	717	9,103	150,098	41,570	12,594	28,186	3,112
Grand Rapids & Indiana	575	329,797	108,627	476,213	58,530	89,414	10,960	178,316	595	15,052	352,869	123,344	24,081	99,121	28,294

REVENUES AND EXPENSES OF RAILWAYS

MONTH OF APRIL, 1916—CONTINUED

Name of road.	Average mileage operated during period.	Operating revenues: Freight.	Operating revenues: Passenger.	Operating revenues: Total (inc. misc.)	Operating expenses: Maintenance of: Way and structures.	Operating expenses: Maintenance of: Equipment.	Operating expenses: Traffic.	Operating expenses: Transportation.	Operating expenses: Miscellaneous.	Operating expenses: General.	Operating expenses: Total.	Net from railway operation.	Railway tax accruals.	Operating income (or loss).	Increase (or decr.) comp. with last year.
Grand Trunk Western	347	672,000	103,000	820,747	67,329	103,413	15,148	262,466	4,741	14,323	467,422	353,324	32,970	320,206	227,747
Great Northern	8,102	4,836,068	1,029,946	6,465,191	1,387,624	843,720	113,127	1,844,523	71,525	119,179	4,356,864	2,108,327	406,942	1,700,912	1,072,246
Gulf & Ship Island	308	137,230	27,021	173,641	16,788	24,005	3,115	48,337	309	7,017	99,571	74,070	6,944	67,094	22,368
Gulf, Colorado & Santa Fe	1,938	848,376	199,834	1,133,530	202,882	192,828	28,183	443,493	......	41,688	902,237	231,293	53,562	177,709	3,993
Hocking Valley	350	369,922	66,582	479,691	56,435	162,770	8,029	154,439	......	14,501	396,174	83,517	43,200	40,317	—65,594
Houston, East & West Texas	191	104,359	25,167	137,022	22,486	20,450	2,022	41,008	761	3,021	98,444	47,578	5,108	42,418	1,628
Houston & Texas Central	895	318,602	95,005	451,288	85,286	66,298	14,442	170,334	6,401	17,780	359,724	91,564	30,517	60,911	60,746
Illinois Central	4,767	3,891,797	1,058,869	5,394,780	789,800	1,339,358	100,868	1,770,492	31,335	146,238	4,172,000	1,222,779	314,200	907,085	371,632
Indiana Harbor Belt	110	......	......	401,194	40,446	76,438	3,604	152,743	......	7,871	281,102	120,091	7,680	112,386	27,021
International & Great Northern	1,160	605,628	133,026	798,426	119,922	142,633	22,226	346,767	9,574	27,848	654,355	144,071	40,000	103,954	108,996
Kanawha & Michigan	177	230,572	31,135	269,276	37,921	70,763	2,759	71,168	......	6,772	189,384	79,893	13,650	66,243	1,300
Kansas City, Mexico & Orient	738	156,209	25,439	194,254	42,205	40,201	8,926	91,194	......	11,828	194,354	—101	11,000	—11,102	20,245
Kansas City Southern	836	685,706	122,949	892,080	89,532	115,446	24,826	275,819	......	34,511	527,577	354,503	48,376	305,738	45,316
Lake Erie & Western	900	505,373	55,593	585,091	69,731	104,656	14,880	180,545	......	12,462	382,276	202,815	25,000	177,774	109,252
Lehigh & Hudson River	96	131,896	4,004	182,606	15,002	18,599	1,432	61,781	......	4,171	100,987	81,619	5,000	76,619	2,454
Lehigh & New England	296	217,176	1,174	233,599	37,167	34,354	2,451	70,862	......	7,768	152,503	81,097	8,820	72,239	—43,144
Lehigh Valley	1,442	3,063,411	350,491	3,692,001	266,288	624,056	83,299	1,457,257	12,414	84,751	2,526,907	1,165,094	140,000	1,024,390	—226,081
Long Island	397	379,087	589,974	1,113,661	147,516	136,841	10,032	466,679	6,236	32,850	798,666	314,995	72,627	242,230	48,470
Louisiana & Arkansas	278	140,885	14,428	159,181	22,297	17,054	3,414	37,106	......	4,371	84,244	74,937	7,920	67,015	26,925
Louisiana Ry. & Navigation Co.	351	124,580	24,507	160,986	21,352	25,296	5,794	58,636	......	6,060	117,139	43,847	9,500	34,339	7,752
Louisiana Western	208	145,943	54,205	213,739	26,741	27,798	7,185	50,307	1,796	5,785	119,608	94,131	9,983	84,112	58,030
Louisville & Nashville	5,037	3,868,576	946,264	5,173,198	703,279	961,455	117,669	1,508,412	18,624	107,772	3,410,328	1,762,869	195,713	1,566,566	809,090
Louisville, Henderson & St. Louis	199	97,743	32,635	138,341	28,872	14,068	4,920	38,578	......	3,347	89,786	48,554	3,800	44,604	25,736
Maine Central	1,220	673,024	235,829	973,530	121,449	145,119	9,432	348,773	1,820	29,759	656,204	317,325	49,608	267,690	69,374
Michigan Central	1,803	2,591,218	798,782	3,837,897	447,367	556,307	68,396	1,319,822	52,158	71,779	2,515,831	1,322,066	140,000	1,181,328	520,773
Midland Valley	380	123,604	38,427	169,419	29,213	33,128	2,531	54,190	......	6,410	125,474	43,944	7,549	36,360	28,606
Minneapolis & St. Louis	1,646	604,027	142,233	794,823	113,415	118,463	16,931	296,802	94	22,102	567,806	227,017	43,237	183,407	—8,643
Minneapolis, St. Paul & S. S. Marie	4,229	1,994,475	473,546	2,650,431	269,544	365,589	53,515	811,659	13,266	60,321	1,571,742	1,078,688	102,787	975,902	461,218
Missouri & North Arkansas	365	63,382	28,310	99,833	18,927	19,687	3,128	37,055	......	5,925	84,722	15,111	5,800	9,311	37,494
Missouri, Kansas & Texas System	3,865	1,747,447	588,227	2,554,503	669,746	494,430	57,847	907,670	18,423	93,101	2,241,217	313,285	131,869	180,784	—396,018
Missouri, Oklahoma & Gulf	334	93,559	22,328	120,980	27,812	22,933	5,218	46,600	114	7,732	110,410	10,570	8,272	2,298	41,659
Missouri, Oklahoma & Gulf of Texas	125	18,202	371	18,767	3,344	2,926	2,122	8,710	......	1,667	18,769	—2	361	—363	2,544
Missouri Pacific	3,931	2,070,804	357,754	2,637,240	426,635	746,794	80,235	923,327	6,649	63,069	2,241,605	395,635	108,062	286,815	—47,148
Mobile & Ohio	1,122	906,538	99,888	1,062,437	97,272	213,695	33,935	346,690	2,269	33,098	726,961	335,475	36,460	298,891	63,978
Monongahela	108	157,505	8,549	168,623	24,480	15,863	839	36,530	......	4,815	82,528	86,094	4,000	82,094	......
Morgan's La. & Texas R. R. & S. S. Co.	405	276,702	90,884	396,068	52,582	46,428	12,332	129,615	2,003	11,057	253,990	142,078	21,667	120,199	70,026
Nashville, Chattanooga & St. Louis	1,230	782,050	209,343	1,079,953	159,708	207,623	52,759	367,012	7,931	39,923	833,537	246,416	27,000	219,210	106,494
Nevada Northern	165	151,835	11,916	167,980	17,022	15,099	598	28,347	86	4,193	65,347	102,633	6,306	96,327	36,602
New Orleans & North Eastern	203	227,959	50,507	308,583	34,772	51,465	9,830	90,316	6,074	12,138	204,598	103,985	15,500	88,485	34,524
New Orleans, Mobile & Chicago	402	154,697	24,024	187,490	26,195	24,844	4,127	56,526	—7	6,583	118,268	69,223	6,431	62,775	24,974
New Orleans Great Northern	285	123,671	25,565	166,761	18,574	17,945	2,734	38,816	188	6,537	84,793	81,968	3,381	78,587	34,736
New Orleans, Texas & Mexico	285	114,247	22,226	145,580	6,703	21,182	5,252	55,999	......	8,913	98,052	47,528	1,501	46,027	46,344
New York Central Railroad	6,093	11,704,037	3,853,113	18,022,119	1,891,584	3,034,871	237,204	5,884,101	225,701	379,279	11,652,740	6,369,379	772,093	5,594,739	1,550,770
New York, Chicago & St. Louis	569	1,168,767	89,916	1,306,062	92,916	246,680	42,740	506,635	4,025	22,123	915,122	390,939	40,000	350,899	247,211
New York, New Haven & Hartford	2,004	3,269,587	2,508,416	6,638,131	685,301	898,339	38,811	2,615,503	82,014	161,788	4,481,090	2,157,040	250,000	1,904,918	454,624
New York, Ontario & Western	568	504,353	83,607	700,599	69,653	138,304	7,534	294,365	......	15,939	525,797	174,802	21,000	153,802	—42,850
New York, Philadelphia & Norfolk	112	343,847	35,012	405,523	28,343	74,411	5,700	146,671	3,950	10,354	267,998	137,525	8,500	128,968	95,100
New York, Susquehanna & Western	140	194,899	56,243	286,472	21,702	33,169	2,030	149,439	......	5,650	211,937	74,535	14,100	60,435	—50,461
Norfolk & Western	2,085	4,016,629	476,958	4,676,972	556,948	840,518	62,146	1,157,525	9,077	83,190	2,678,591	1,998,381	175,000	1,823,119	595,197
Norfolk Southern	908	306,810	79,532	407,308	43,978	57,447	7,076	134,355	78	17,146	260,029	147,279	12,846	134,387	63,149
Northern Pacific	6,509	4,943,685	1,008,637	6,450,096	889,303	708,069	95,439	1,698,214	76,080	97,540	3,551,239	2,898,857	564,071	2,334,136	904,905
Northwestern Pacific	506	127,808	154,844	327,855	39,717	53,124	5,234	114,494	864	7,867	220,329	107,526	16,944	90,500	54,880
Oahu Railway & Land Co.	114	69,554	21,095	99,840	7,668	6,739	652	23,912	......	4,315	43,287	56,553	8,500	48,053	6,675
Oregon Short Line	2,258	1,465,984	368,220	1,973,219	222,405	217,463	31,323	445,562	25,974	56,854	999,583	973,635	131,600	841,718	474,019
Oregon-Washington R. R. & Nav. Co.	2,053	990,934	326,772	1,442,138	250,999	158,284	39,000	478,230	18,908	66,979	1,006,058	436,081	93,800	342,220	104,052
Panhandle & Santa Fe	670	403,521	69,899	502,630	94,755	79,598	5,036	121,207	......	11,548	311,777	190,853	10,573	180,281	151,836
Pennsylvania Company	1,758	4,510,239	918,800	5,946,168	871,083	1,042,763	76,872	1,962,674	33,972	142,702	4,127,678	1,818,489	291,240	1,527,709	797,796
Pennsylvania Railroad	4,541	13,456,722	3,664,678	18,825,483	2,277,189	3,752,147	216,350	6,478,927	253,611	443,714	13,421,939	5,403,544	679,530	4,720,765	1,367,236
Pere Marquette	2,248	1,395,060	319,145	1,875,627	167,569	393,109	31,389	637,379	3,594	39,790	1,272,283	603,344	50,871	552,255	182,618
Philadelphia & Reading	1,120	3,924,837	558,170	4,745,411	344,370	713,030	40,094	1,618,958	13,121	77,683	2,805,784	1,939,627	100,252	1,838,762	473,949
Philadelphia, Baltimore & Washington	717	1,046,607	890,256	2,133,194	256,164	350,177	31,628	764,927	125	52,617	1,455,640	677,553	56,687	620,848	285,776
Pittsburgh & Lake Erie	224	1,626,570	157,760	1,900,769	164,764	295,726	14,613	422,924	3,519	31,807	933,354	967,414	58,700	908,714	429,561
Pittsburgh, Cincinnati, Chic. & St. Louis	1,488	2,850,591	713,100	4,023,423	590,354	854,143	62,089	1,405,579	25,858	101,128	3,038,184	985,238	179,827	805,320	234,217
Pittsburgh, Shawmut & Northern	294	164,464	10,157	176,916	34,571	52,347	1,720	60,187	......	4,759	153,584	23,332	1,869	21,463	—11,754
Pt. Reading	21	135,419	......	156,941	6,629	10,903	38	68,610	......	211	86,391	70,550	10,000	60,550	7,750
Richmond, Fredericksburg & Potomac	88	183,224	114,828	346,044	26,153	32,481	3,568	93,975	5,912	8,918	171,008	175,036	10,000	165,023	61,906
Rutland	468	239,018	99,561	378,391	38,523	57,175	8,719	130,863	1,021	6,306	242,606	135,784	17,501	118,284	39,543
St. Joseph & Grand Island	258	122,172	22,328	154,095	42,045	23,979	4,368	51,582	460	4,772	127,208	26,887	7,962	18,880	9,028
St. Louis & San Francisco	4,750	2,823,317	848,995	3,921,270	635,273	619,995	64,747	1,225,230	......	99,661	2,599,048	1,322,221	180,316	1,140,592	283,896
St. Louis, Merchant's Bridge Terminal	9	......	322	183,904	32,281	8,291	867	84,196	......	6,740	132,374	51,530	7,600	43,930	15,993
St. Louis, San Francisco & Texas	244	52,785	23,726	83,786	21,419	19,057	2,557	47,778	......	4,504	95,315	—11,529	1,566	—13,433	—9,662
St. Louis, Brownsville & Mexico	548	143,953	57,575	219,339	25,037	31,308	7,738	99,393	......	12,426	173,049	46,290	8,000	36,670	—30,117
St. Louis, Iron Mountain & Southern	3,555	2,046,614	498,202	2,753,904	564,340	433,335	74,202	797,198	12,309	59,243	1,926,634	827,270	129,172	696,339	143,588
St. Louis Southwestern	94	557,735	95,815	693,888	57,942	106,619	31,103	166,105	2,556	25,070	389,139	304,749	29,751	274,765	87,769

REVENUES AND EXPENSES OF RAILWAYS

MONTH OF APRIL, 1916—CONTINUED

Name of road.	Average mileage operated during period.	Operating revenues: Freight.	Operating revenues: Passenger.	Operating revenues: Total (inc. misc.)	Operating expenses: Maintenance of: Way and structures.	Operating expenses: Maintenance of: Equipment.	Operating expenses: Traffic.	Operating expenses: Transportation.	Operating expenses: Miscellaneous.	Operating expenses: General.	Operating expenses: Total.	Net from railway operation.	Railway tax accruals.	Operating income (or loss).	Increase (or decr.) comp. with last year.
St. Louis Southwestern of Texas	810	222,215	58,301	308,276	68,679	69,831	12,595	148,165	1,471	18,594	305,908	2,368	16,773	—14,424	—377
San Antonio & Aransas Pass	724	170,091	61,975	253,627	75,329	47,924	6,434	143,096	....	11,964	284,522	—30,894	11,000	—41,894	—6,580
San Pedro, Los Angeles & Salt Lake	1,154	689,231	231,469	1,019,949	101,554	124,641	36,361	265,665	18,180	17,899	563,632	456,316	44,823	411,339	97,476
Seaboard	3,449	1,538,494	410,142	2,182,720	262,605	310,593	68,307	703,706	14,121	60,812	1,420,147	762,572	101,280	659,786	....
Southern	7,022	4,315,736	1,322,513	6,181,497	688,877	925,867	160,268	1,931,817	35,971	169,994	3,886,761	2,294,736	254,731	2,038,246	738,103
Southern Pacific	6,952	6,280,245	2,191,112	9,259,893	978,268	1,411,789	155,298	3,011,948	143,869	240,650	5,926,340	3,333,554	421,651	2,910,792	785,490
Spokane, Portland & Seattle	555	241,048	105,707	381,248	67,365	45,725	7,471	90,748	3,148	14,510	228,905	152,342	57,445	94,793	72,235
Staten Island Rapid Transit Co.	10	44,928	24.786	99,535	9,931	7,762	679	37,233	....	2,464	58,072	41,463	5,500	35,963	—6,218
Tennessee Central	293	104,421	29,432	141,282	21,941	23,115	6,300	48,076	....	7,259	106,664	34,617	4,683	29,923	13,683
Terminal Railroad Ass'n of St. Louis	37	....	259	280,730	38,757	13,999	968	85,999	....	4,422	144,143	136,587	27,402	109,186	37,426
Texas & New Orleans	468	258,926	75,495	376,175	74,395	61,551	8,339	127,958	9,748	19,514	291,135	85,040	19,816	64,938	42,393
Texas & Pacific	1,944	1,072,913	313.384	1,500,811	160,148	228,928	38,291	643,516	11,785	79,424	1,159,655	341,156	68,700	271,962	210,956
Toledo & Ohio Central	435	326,425	45 050	393,761	56,585	110,555	7,746	156,652	1,547	10.290	343,378	50.383	23,501	26,876	—20,360
Toledo, Peoria & Western	247	47,073	32,695	86,016	14,243	27,293	2,126	34,333	....	3,741	81,738	4.278	6,500	—2,222	—20,879
Toledo, St. Louis & Western	451	406,694	28,682	459,361	57,050	65,994	14,667	154,206	....	7,899	299,282	160,078	20,600	139,478	118,093
Ulster & Delaware	129	46,294	12,179	75,602	4,886	11,469	1,007	29,509	61	3,776	50,708	24,894	3,500	21,394	—4,158
Union Pacific	3,622	3,780,493	808,761	5,063,968	767,617	652,596	91,373	1,215,032	74,646	126,702	2,904,984	2,158,983	210,700	1,947,491	845,079
Union R. R. of Baltimore	8	130,386	29,080	161,577	8,823	....	....	5,184	....	2,105	16,113	145,463	5,723	139,740	31,928
Union R. R. of Pennsylvania	30	....	....	372,717	40,003	107,740	143	166,239	....	4,059	318,186	54,531	7,000	47,530	67,567
Vandalia	917	640,573	195,398	946,606	97,355	231,946	23,338	365,266	10,413	26,598	754,919	191,686	36,867	154,724	33,163
Vicksburg, Shreveport & Pacific	171	84,847	35.272	134,929	22,944	20,575	3,764	42,349	2,125	5,332	97,090	37,840	8,180	26,660	24,520
Virginia & Southwestern	225	135,188	13.431	154,894	28,374	51,612	2,098	44,103	....	4,701	130,888	24.006	7,614	16,392	—10,404
Virginian	505	537,093	36,906	612,343	58,682	99,966	5,589	122,819	12,612	17,723	317,067	295,275	26,900	268,323	28,170
Wabash	2,519	2,236,121	492,879	2,984,868	311,681	461,371	87,306	1,069,264	14,760	66,520	2,007,902	976,966	90,261	886,416	566,874
Washington Southern	36	58,701	66,798	165,890	18,385	21,614	1,550	45,968	2,727	4,414	94,658	71,232	4,450	66,779	30,706
West Jersey & Seashore	358	209,758	358,015	614,445	98,728	107,622	11,432	233,333	2,191	17,217	470,525	143,920	36,358	107,527	73,124
Western Maryland	688	800,847	75,532	931,834	106,979	145,682	22,981	280,788	8,450	20,927	585,372	346,461	31,000	315,461	83,049
Western Pacific	941	575,759	77.863	686,792	103,958	58,361	20,351	202,633	9,546	17,269	412,118	274,674	31,676	242,993	172,918
Western Ry. of Alabama	133	62.923	31,940	109,066	15,459	21,053	5,821	32,134	1,914	4,436	80,817	28,249	5,341	22,356	4,148
Wheeling & Lake Erie	512	644,427	52,822	755,730	92,446	117,946	8,529	234,931	1,553	16,871	472,275	283,455	39,444	243,947	196,461
Yazoo & Mississippi Valley	1,382	809,435	182,329	1,048,427	159,478	168,237	18,974	354,893	1,583	29,286	731,924	316,502	52,000	264,040	37,922

TEN MONTHS OF FISCAL YEAR, 1916

Name of road.	Average mileage operated during period.	Operating revenues: Freight.	Operating revenues: Passenger.	Operating revenues: Total (inc. misc.)	Operating expenses: Maintenance of: Way and structures.	Operating expenses: Maintenance of: Equipment.	Operating expenses: Traffic.	Operating expenses: Transportation.	Operating expenses: Miscellaneous.	Operating expenses: General.	Operating expenses: Total.	Net from railway operation.	Railway tax accruals.	Operating income (or loss).	Increase (or decr.) comp. with last year.
Alabama & Vicksburg	143	$939,928	$339,065	$1,401,985	$173,949	$304,470	$37,217	$477,997	$20,840	$54,556	$1,069,001	$332,978	$87,795	$245,183	$183,016
Alabama Great Southern	309	3,318,359	927,115	4,578,044	432,975	1,062,922	130,307	1,349,138	29,968	89,278	3,092,846	1,485,198	164,924	1,320,184	564,223
Ann Arbor	294	1,618,967	451,291	2,206,379	189,538	317,610	47,741	799,415	4,431	110,505	1,469,240	737,139	137,910	598,745	176,223
Arizona Eastern	378	2,133,444	351,275	2,638,151	453,355	267,442	23,636	564,178	12,021	109,571	1,427,525	1,210,627	184,556	1,025,996	540,660
Atchison, Topeka & Santa Fe	8,620	61,023,663	23,081,907	91,989,115	12,360,017	14,313,047	1,955,135	24,921,222	....	1,890,170	55,273,381	36,175,734	4,434,213	32,258,610	6,735,947
Atlanta & West Point	93	612,023	385,143	114,651	135,641	219,144	60,550	333,578	20,222	44,991	813,963	332,547	61,288	266,154	133,209
*Atlanta, Birmingham & Atlantic	640	783,768	148,279	1,007,266	164,953	188,884	55,361	383,506	106	35,353	828,165	179,101	52,400	126,701	....
Atlantic & St. Lawrence	167	1,313,181	226,601	1,660,283	212,757	243,768	40,041	727,106	....	43,328	1,267,000	393,282	115,050	278,220	86,559
Atlantic City	170	750,615	1,147,002	2,001,226	319,338	200,463	32,062	999,763	998	14,985	1,567,605	433,621	100,000	333,427	166,580
Atlantic Coast Line	4,705	19,266,777	7.082,379	28,672,595	3,637,501	4,555,189	587,009	9,340,599	108,398	725,134	18,933,053	9,739,542	1,509,000	8,127,376	2,156,295
Baltimore & Ohio	4,535	72,261,796	12,202,371	91,121.549	10,881,295	19,531,158	1,610,364	30,241,527	549,427	2,029,174	64,832,555	26,288,994	2,986,029	23,272,693	4,433,997
Baltimore & Ohio Chicago Terminal	79	....	5.502	1,456,079	154,554	188,407	9,037	682,052	15,792	79.366	1,099,854	356,225	187,589	167,103	—24,483
Baltimore, Chesapeake & Atlantic	88	559.831	328,485	929,481	67,861	275,968	13,734	503,120	....	32,006	892,669	36,811	22,399	14,376	—75,996
Bangor & Aroostook	632	2,404,269	543,355	3,132,660	458,520	492,123	28,048	863,164	31,188	113.966	1,986,363	1,146,297	129,300	1,016,962	—25,644
Belt Ry. Co. of Chicago	31	....	....	2,404,898	173,107	308,420	9,820	1,047,025	....	60,385	1,598,757	806,141	122,987	683,154	—470,812
Bessemer & Lake Erie	205	8,013,251	311.578	8,498,581	692,969	1,669,446	94,099	1,997,044	....	148.555	4,484,083	4.014,488	188,662	3,825,801	1,391,261
Bingham & Garfield	27	1,645,674	32,805	1,688,097	163,560	163,725	10,392	216,685	978	23,725	579,064	1,109,033	45,894	1,063,139	507,588
Boston & Maine	2,302	26.090.782	12.516.167	42,608,110	4,981,269	5,412,901	334,001	18,060,982	162,118	1,027,460	29,978,732	12,629,378	1,642,653	10,986,725	4,009,778
Buffalo & Susquehanna R. R. Corp.	253	1,337,419	67,380	1,425.807	203,422	361,881	10,981	390,922	....	55,129	1,022,334	403,473	26,000	377,470	229,163
Buffalo, Rochester & Pittsburgh	586	8,530,288	946.354	9,820,409	1,347,958	2,223,441	117,384	3,153,889	12,260	219.142	7,074,073	2,746,336	200,000	2,546,214	712,258
Canadian Pacific Lines in Maine	233	1,463,690	176,863	1,740,678	193,701	209,705	52,553	691,949	....	36,847	1,184,753	555,924	96,000	459,924	380,507
Carolina, Clinchfield & Ohio	283	2,156.507	176,677	2,382,060	241,159	306,411	106,065	427,568	....	95,230	1,166,306	1,215,754	133,000	1,082,624	369,724
Carolina, Clinchfield & Ohio of S. C.	18	122.594	13,363	139,724	13,877	858	18,843	25,037	....	7,681	65,993	73,730	7,000	66,730	19,164
Central of Georgia	1,924	7.018,793	2,551,890	10.629,508	1,422,005	1,791,949	353,931	3,429,388	14,064	380,742	7,383,306	3,246,202	530,417	2,707,944	363,637
Central of New Jersey	681	20,851,005	5,076,854	27,646,282	2,253,671	4,638,798	304,022	9,697,500	133,799	575.608	17,600,484	10,045,799	1,537,795	8,507,500	1,661,998
Central New England	304	3,414,106	362,768	3,954,826	430,163	350,059	11,812	1,255,126	....	48,198	2,094,483	1,860,343	140,000	1,720,155	641,231
Central Vermont	41	2,487,076	752,708	3,533,849	375,687	559,820	84,665	1,561,428	22,794	78,204	2,682,598	851,251	156,100	695,117	276,898
Charleston & Western Carolina	343	1,215,820	283.698	1,586,128	263,832	199,583	32,375	508,585	....	47,845	1,051,844	534,284	50,000	483,951	203,655
Chesapeake & Ohio Lines	2.374	32,366,498	4,937,941	39,773,421	4,527,486	8,929,708	529,738	11,456,248	229,946	784,230	26,443,035	13,330,385	1,282,720	12,028,316	3,528,652
Chicago & Alton	1,052	9,229,949	3,208,535	13,484,663	1.504,183	2,911,502	348,643	4,557,463	96,355	305,098	9,668,393	3,816,270	454,608	3,356,840	1,314,889
Chicago & Eastern Illinois	1,136	10,551,002	2,423,157	14,080,199	1,864,371	3,340,961	251,426	4,848,140	79,395	377,901	10,738,435	3,341,765	578,457	2,758,824	684,161
Chicago & Erie	269	5,411,428	480 747	6.390,446	570,140	636,761	173,662	2,407,933	21,326	142,464	3.942,831	2,447,615	270,402	2,227,212	1,078,882
Chicago & North Western	8,108	49,846,949	17,708.321	75,280,416	8,959,412	12,221,005	1,093,513	26,664,987	540,539	549,878	50,849,685	24,430,732	3,890,000	20,528,292	3,962,984
Chicago, Burlington & Quincy	9,369	59,932,852	17,665,555	85,478,863	9,173,818	12,667,794	1,273,505	25,067,356	746,392	1,655.197	50,584,062	34,894,802	3,653,643	31,241,159	7,670,449
Chicago Great Western	1,496	8,826,675	2,727,143	12,619,871	1,612,236	2,120,441	449,027	4,439,416	85,443	334,783	9,027,896	3,591,974	458,044	3,125,738	729,712

*Figures shown here are for four months ending April 30.

Traffic News

Sleeping cars are now run through between New York and New Orleans over the Central of New Jersey, Philadelphia & Reading, Baltimore & Ohio and Illinois Central Railroads. The route is via Baltimore, Washington, Cincinnati, Louisville and Memphis.

In the United States Court at Philadelphia, June 10, the Philadelphia & Reading Railway was indicted by the grand jury on charges of operating barges without having filed freight tariffs, and with allowing coal to stand in cars without collecting the legal compensation for demurrage.

The Pennsylvania is making extensive additions to its elevator plant at Buffalo; an additional marine leg and extensions of the weighing and car-loading apparatus. They will make it possible to unload grain from a vessel at the rate of 40,000 bushels an hour, and to pour it into cars, out of the bins, at the rate of 45,000 bushels hourly.

Beginning June 25 the Lehigh Valley and the Pennsylvania are to run a day express train each way between Easton, Pa., and Pittsburgh, the time through being a little less than 12 hours. The route is over the Lehigh Valley from Easton through South Bethlehem, Allentown, Mauch Chunk and Hazleton to Mount Carmel, and thence over the Pennsylvania through Sunbury, Williamsport, Lock Haven, Tyrone, Altoona and Johnstown.

The Department of Commerce announces at Washington that a new steamship line is to be established within a few weeks between Japan and New York via the Panama Canal. The Nippon Yusen Kaisha will run a steamer over this route to New York every four weeks, making thirteen round trips a year. It is believed the Nippon Yusen Kaisha will not bind itself by the New York conference freight rates, and that consequently there may be a reduction of rates from Japan. It is estimated that to return by the Panama Canal will reduce the sailing time of the steamers making the trip to New York via Europe by three weeks.

Freight Car Surpluses and Shortages

The American Railway Association Committee on Relations between Railroads has issued its statistical statement No. 17, giving a summary of freight car surpluses and shortages for June 1, 1916, with comparisons as follows:

Total Surplus

June 1, 1916	67,588
May 1, 1916	63,344
June 1, 1915	300,146

The surplus for May 1, 1916, includes figures reported since the issue of Statistical Statement No. 16. There is a small increase in the total surplus over May 1. The principal box car surplus is west and northwest of Chicago, in which territory the surplus of this class of equipment shows a large increase with a smaller increase on the Pacific coast. The coal car surplus shows a reduction west and northwest of Chicago and C. F. A. territory. The miscellaneous car surplus is mostly in the West (Group 6), and on the Pacific coast.

Total Shortage

June 1, 1916	12,344
May 1, 1916	29,983
June 1, 1915	218

The shortage for May 1, 1916, includes figures reported since the issue of Statistical Statement No. 16. The total shortage shows a large reduction from May 1, bringing the total down to 12,344. There is very little shortage of any class of equipment in any one section.

The figures by classes of cars follow:

Classes—	Surplus	Shortage
Box	26,227	5,225
Flat	3,874	770
Coal and gondola	14,373	5,556
Miscellaneous	23,114	793
Total	67,588	12,344

Commission and Court News

INTERSTATE COMMERCE COMMISSION

Proposed increases in rates on salt from Hutchinson and other Kansas points to points in Missouri have been suspended until September 29 by the Interstate Commerce Commission.

The Interstate Commerce Commission has ordered a revision of freight rates on bituminous coal from mines in Illinois, Kentucky and Alabama to points in Alabama, Mississippi, Louisiana and Tennessee, to become effective on August 1. In general, rates from Alabama fields to Mississippi and Louisiana are lowered from 5 to 20 cents a ton, and from Illinois and Kentucky mines to the same points are increased. The declared purpose of the revision is to place mines in Illinois and Kentucky more nearly on a competitive basis with mines in Alabama.

Rates on Cotton Piece Goods from Henderson, Ky.

Henderson Cotton Mills v. Louisville & Nashville et al. Opinion by Commissioner Clark:

The commission finds that the rates on cotton piece goods from Henderson, Ky., to Boston, Mass., Norwich, Conn., Providence, R. I., New York, Baltimore, Md., and other points in trunk line territory, are not unreasonable or discriminatory. Complaint dismissed. Fourth section relief denied. (39 I. C. C., 399.)

Rates from Ironton, Ohio

Goldcamp Mining Company v. Norfolk & Western. Opinion by Commissioner Clark:

Defendant's rates on grain, grain products and hay in carloads and less than carloads from Ironton, Ohio, to points on defendant's line in West Virginia, Naugatuck to Bluefield, inclusive, are found unreasonable, and reasonable maximum rates are prescribed for the future. Reparation denied. (39 I. C. C., 433.)

Furnace Allowances

Pittsburgh Steel Company et al. v. Pittsburgh & Lake Erie. Opinion by Commissioner Harlan:

The commission finds that the defendant by its refusal to make a furnace allowance to the complainants, the Pittsburgh Steel Company and its subsidiary, the Monessen Southwestern, while at the same time making such allowances to complainants' competitors in the same industrial district, subjected the complainants to an unlawful disadvantage. (39 I. C. C., 312.)

Coal from Mines on the Cumberland Railroad

Brush Creek Mining & Manufacturing Co. et al. v. Louisville & Nashville et al. Opinion by the commission.

Carload rates of the Cumberland Railroad and the Louisville & Nashville on coal from mines on the Cumberland Railroad to the northwest and the southeast are found not to be discriminatory because they exceed group rates of the Louisville & Nashville to and from the same territories from and to mines on that road, but they are found to be unreasonable to the extent that they exceed such group rates by more than five cents per ton, and the defendants required to publish rates on that basis. Reparation denied. Rates on inbound supplies to mines on the Cumberland Railroad are not found to be unreasonable or discriminatory. (39 I. C. C. 449.)

STATE COMMISSIONS

The Railroad Commission of Louisiana will hold a session on June 21, to take up for consideration and hearing Case No. 2,519, an ex parte hearing of the application by the railroads east of the Mississippi river for use on Louisiana business of Southern Classification No. 42.

Arrangement has been made by the commissions of the several states, which are members of the National Association of Railway Commissioners, for the publication under the auspices of that organization of the decisions of all the commissions under the title "Official Public Service Reports."

Commissioner James O. Carr, of the New York State Public Service Commission, Second district, has gone to Europe. He expects to spend six weeks studying the transportation systems of England, France and Italy, as these systems have developed under the tremendous strain of war conditions. Mr. Carr's trip is without expense to the state.

The Texas Railroad Commission has authorized considerable increases in freight rates. The railroads applied for a horizontal increase of 15 per cent. Many hearings were held, and except in a few instances shippers opposed the new rates. The commission at the conclusion of the public hearings began a long study of the testimony; and the last of the new tariffs, with the exception of the cotton tariff, has now been issued. It applies to general class rates, and shows an increase of about 8 per cent over the old rates. The Galveston differential is abolished in this new tariff. An analysis of the different tariffs that the commission has issued shows total increases estimated at about 10 per cent.

Grade Crossing Safety in Colorado

The action of the American Railway Association on the question of safety at highway grade crossings, including a recommendation for uniform action by the legislatures and the commissions of the several states, was reported in the *Railway Age Gazette* of June 9, page 1219. One state, Colorado, which is now the residence of H. U. Mudge, president of the American Railway Association, has already taken action in this matter, a report of the Public Utilities Commission of that state, No. 56, dated May 27, having been issued last week. In this report the Commission lays down rules for the construction of crossings and announces that in matters wherein uniformity is desirable, the Commission intends to await the action of the American Railway Association. Mr. Mudge, together with officers of other roads, appeared before the Commissioners and explained to them what the association had done. The Commission's report is summarized under eleven heads, and is addresed to 50 different railroad companies:

1. In the matter of distant signals on the highways, outside the railway right of way, the Commission hands the question over to the State Highway Commission.

2. The Commission has in the past ordered the installation of automatic signals, and in some cases required the employment of flagmen; it will now await the report of the American Railway Association if said report is made within a reasonable time.

3. There are in Colorado 3,676 grade crossings, of which 254 have gates or flagmen or bells.

4. The number of accidents at crossings has greatly increased.

5. The legislature has given the Public Utilities Commission full authority in the matter of safety.

6. The elimination of all crossings is unnecessary and impracticable; but the time has arrived to adequately protect crossings by automatic signals.

7. Travel on the highways is increasing, and a uniform rule must be prescribed for the action of the railways in providing adequate protection. It should be the position of the state of Colorado to assist the carriers in their efforts to protect crossings at grade by furnishing and maintaining, at the state's expense, uniform signals on the highways in addition to the means now used.

8. The railroads are required to send in plans and descriptions showing all crossings, with necessary details; and, in this matter—

(9) A uniform rule is prescribed, subject however, to exceptions.

10. The railroads are ordered to provide, within a reasonable time, and to maintain at state highways, grade crossings 24 ft. wide; at other highways, 16 ft. wide; the roadway to be level with the rails for 18 ft. outside the track; grades of approaches not to exceed 6 per cent; the roadway to be well drained and surfaced with gravel or other suitable material. Crossings within city or town limits to be planked 10 inches on the outside and inside of each rail, and the space in the center of the track to be filled with gravel or other suitable material. Crossings not within city or town limits may have planking or gravel, or other suitable material.

11. On forms furnished by the Commission the railroads are to report alinement and grade of the railway at each location.

UNITED STATES SUPREME COURT

Damages for Death—Earning Power of Money to Be Considered

The Supreme Court of the United States has reversed two judgments of the Kentucky Court of Appeals in actions for death under the federal employers' liability act on the ground that the verdicts, for $19,011 and $16,000 respectively, were erroneously computed and excessive. The state court held that the whole loss is sustained at the time of the employee's death, and is to be included in the verdict without rebate or discount. The United States Supreme Court holds, however, that account must be taken of the earning power of the money that is to be awarded. The putting out of money at interest is at this day so common that ordinarily it cannot be excluded from consideration in determining the present equivalent of future payments, since a reasonable man, even from selfish motives, would probably gain some money by way of interest on the money recovered. In short, when future payments or other pecuniary benefits are to be anticipated, the verdict should be made on the basis of their present value only.

"We are aware," the court said, by Mr. Justice Pitney, "that it may be a difficult mathematical computation for the ordinary juryman to calculate interest on deferred payments, with annual rests, and reach a present cash value. Whether the difficulty should be met by admitting the testimony of expert witnesses, or by receiving in evidence the standard interest and annuity tables in which present values are worked out at various rates of interest, and for various periods covering the ordinary expectancies of life, it is not for us in this case to say. Like other questions of procedure and evidence, it is to be determined according to the law of the forum.

"But the question of the proper measure of damages is inseparably connected with the right of action, and in cases arising under the federal employers' liability act it must be settled according to general principles of law as administered in the federal courts.

"We are not reminded that in any previous case in this court the precise question now presented has been necessarily involved." Chesapeake & Ohio v. Kelly. The same principle was applied in Chesapeake & Ohio v. Gainey, decided at the same time. Decided June 5, 1916.

COURT NEWS

Invalid Contract for Expedited Shipment

In an action by a shipper for breach of an interstate carrier's contract for an expedited shipment, it appeared that there was no published tariff for such shipment. The Tennessee Supreme Court holds that the contract was illegal, since it gave an undue advantage to the shipper, and there could be no recovery thereon.—Roberts v. N. C. & St. L. (Tenn.), 185 S. W., 69.

Assumption of Risk on Overcrowded Hand Car

The Kentucky Court of Appeals holds that a section hand assumes the risk of falling off a hand car because of its being overcrowded, where the conditions are open and obvious, and he is aware of them when boarding it, and he did not complain of its condition, and was not directed by the foreman to board it in spite of its condition.—Sparks v. C. & O. (Ky.), 185 S. W., 109.

Arkansas Lookout Statute

Under the Arkansas lookout statute of 1911, the Arkansas Supreme Court holds that a railroad is liable in that state for personal injuries or death of a brakeman of another railroad caused by a collision of its train with another train, if the crew of its train, by keeping a constant lookout, could have seen the other train in time to avoid the collision by exercising

ordinary care; and contributory negligence of the injured person is no longer a defense, as it was under the common law.—Rock Island v. Scott (Ark.), 184 S. W., 65.

Delay in Carriage of Live Stock—Ordinary Schedules

The Nebraska Supreme Court holds, approving the rulings of the Iowa and Maine courts, though cases from Texas and Oklahoma, not cited, appeared to hold the contrary, that, in the absence of a special contract, or special circumstances which take the case out of the general rule, a carrier of live stock is not bound to use extraordinary means to forward a shipment of stock. In such case the shipper will be held to have consented to the carriage of the stock by the regular trains of the carrier on its ordinary schedules.—Payne v. C. M. & St. P. (Neb.), 157 N. W., 613.

Conclusiveness of Judgment for Railroad

In an action against a railroad and the engineer in charge of its engine No. 300, for personal injuries, it was alleged in the petition that the injuries were caused by the negligence of that engineer. Verdict and judgment were given for the defendants. The plaintiff subsequently brought another action against the railroad and its engineer of No. 720 for the same injuries, alleging that they were caused by that engineer's negligence. The Kentucky Court of Appeals holds that the judgment for the railroad in the first action was a bar to the second.—C. N. O. & T. P. (Ky.), 185 S. W., 93.

Making Cuttings—Lateral Support of Land Bought

The Mississippi Supreme Court holds that, where a railroad company properly acquired a parcel of land for a right of way, and the contour of the land rendered a cut necessary, the railroad is not liable to the grantee of the owner of the land for injuries caused by the slipping of the land into the cut, the lateral support being removed. The original grant of the right of way necessarily included a right to make the cut and remove the lateral support. When a right of way is condemned or bought, it is held that the right to do any and all things necessary and proper in the use of it is presumed to have been paid for.—Alabama & Vicksburg (Miss.), 71 So., 377.

Necessity for Agency Station

In an application by the Florida Railroad Commissioners for a writ of mandamus to compel the Florida East Coast to establish and maintain an agency station at Ojus, it appeared that the railroad has an agency station on either side of that point, one a trifle more than 2 miles, and the other only 1.8 miles from it, and that the principal amount of business transacted at Ojus is during a period of four months in the year, during which time a temporary agent is stationed there. The Florida Supreme Court holds that the order made for the maintenance and establishment of an agency station at Ojus is unreasonable, and that no necessity exists for such a station.—State v. F. E. C. (Fla.), 71 So., 543.

Construction of Lookout Statute—Projections from Train

A Tennessee statute provides that every railroad company shall keep the engineer, fireman or some other person on the locomotive always on the lookout ahead, and when any person, animal or other obstruction appears on the road, the alarm whistle shall be sounded, the brakes put on, and every possible means employed to stop the train. In a recent case, C. N. O. & T. P. v. Brock, 132 Tenn., 477, 178 S. W., 1,115, it was held that compliance with this statute is not required until the person appears as an obstruction. Citing this case, the Tennessee Supreme Court holds that the statute does not apply where a trespasser, walking along the right of way, was struck by a piece of scantling which had become loose and projected about six feet from the side of a lumber car; for the engineman did not know of the projecting timber. The timber was not shown to have been in the dangerous position long enough to give rise to constructive knowledge of the danger it threatened. Negligence of the railroad could not therefore be based on the doctrine of res ipsa loquitur.—Preslar v. Mobile & Ohio (Tenn.), 185 S. W., 67.

Railway Officers

Executive, Financial, Legal and Accounting

Roy Terrell, assistant general freight agent of the Gulf Coast Lines, has been promoted to assistant to the president with headquarters at New Orleans, La.

C. M. Levey, general manager of the Western Pacific, now in the hands of the receivers, has been elected president of the new corporation which, under the reorganization plan approved by the federal court, will take over the properties of the old company on June 8.

E. M. Devereux, assistant treasurer and transfer agent of the Baltimore & Ohio at New York, has been elected treasurer, with headquarters at Baltimore, reporting to the second vice-president, and R. B. Luckey, assistant transfer agent, has been promoted to assistant treasurer and transfer agent, with office at New York, succeeding Mr. Devereux. The retirement of J. V. McNeal is noted elsewhere. No action has yet been taken with respect to filling the fourth vice-presidency.

Edward Miffern Devereux, who has been appointed treasurer of the Baltimore & Ohio with headquarters at Baltimore, Md., was born on July 26, 1872, at Dover, N. H., and was educated in Boston preparatory schools and at Harvard University. He began railway work in 1895 in the treasury department of the Union Pacific at Boston, Mass., and in 1898 was transferred to New York with that department. In May of the following year Mr. Devereux entered the service of the Baltimore & Ohio in the treasury department at New York City. In 1903 he was appointed assistant treasurer. On July 1 he becomes treasurer of the same road with headquarters at Baltimore as above noted.

A. W. Trenholm, whose appointment as vice-president and general manager of the Chicago, St. Paul, Minneapolis & Omaha, has been announced, began his railroad service as a water boy during the construction of the Intercolonial in 1869. He remained in the employ of the Intercolonial as water boy and laborer until 1873, when he entered the service of the Grand Trunk as an operator, later becoming a relief agent. In 1876 he returned to the Intercolonial as a clerk in the accounting department, and was later a local agent and relief agent of the same road. In 1880 he first entered the employ of the Omaha. He served as traveling auditor and local agent until January 1, 1893, when he was appointed division superintendent. From March, 1900, to March, 1903, he was general superintendent of the road, and from the latter date until May 24, 1916, was general manager. As vice-president and general manager he will continue to have headquarters at St. Paul, Minn.

A. W. Trenholm

Thomas H. Fittz, whose appointment as claim agent of the Evansville & Indianapolis has been announced, was born in Brunswick county, Va., on June 29, 1887. He began his railroad career in the service of the Richmond, Fredericksburg & Potomac in 1903, as a clerk in the office of the car accountant. In the same year he became claim clerk of the Chesapeake & Ohio at Richmond, Va. In 1905, he took a position in the office of the freight claim agent of the Southern at Washington, D. C., but returned in the same year to the general claim office of the Chesapeake & Ohio at Richmond. In January, 1907, he entered the service of the

Texas & Pacific as a clerk in the claim office at Dallas, Tex., and in September, 1907, became chief claim clerk of the Kansas City, Mexico & Orient. He remained in the service of the Orient until August, 1911, when he entered the claim department of the Atchison, Topeka & Santa Fe at Topeka, Kan., where he remained until March 1, 1912. On October, 1, 1914, he was appointed claim adjuster of the Chesapeake & Ohio at Richmond, Va., which was the position he occupied until his appointment as general claim agent of the Evansville & Indianapolis with headquarters at Terre Haute, Ind.

Joshua Vansant McNeal, fourth vice-president and treasurer of the Baltimore & Ohio Railroad will retire from active service on June 30, at his own request, having reached the age of 70. He was born June 11, 1846, at Baltimore, Md. He was educated in the public schools and at Loyola College, Baltimore, and leaving college in July, 1862, Mr. McNeal engaged in the fire and marine insurance business in Baltimore. He first entered railway service on the Baltimore & Ohio in February, 1871, as a clerk in the general freight office, and in April, 1872, was appointed traveling auditor. From October, 1872, to January, 1880, he was chief clerk of the auditor's office, and was then appointed auditor of the Indianapolis, Decatur & Western (now the Cincinnati, Indianapolis & Western Railroad), remaining in this position until May, 1893. He was then appointed assistant treasurer of the Baltimore & Ohio and was promoted to treasurer September 1, 1899. Mr. McNeal was elected fourth vice-president and treasurer by the board of directors, August 1, 1904.

J. V. McNeal

Operating

John F. Tracy has been appointed trainmaster of the Fargo division of the Northern Pacific, with headquarters at Dilworth, Minn., vice J. H. Johnson, transferred.

R. M. Johnson, yardmaster of the Lehigh Valley at Jersey City, has been appointed to the newly created position of supervisor of stations with office at South Bethlehem, Pa.

D. B. Carson, general manager of the Nashville, Chattanooga & St. Louis has resigned and it is announced that for the present the president, J. H. Peyton will assume the duties of general manager.

J. R. Gilliland, superintendent of the Eastern division of the Canadian Pacific at Smiths Falls, Ont., has been appointed superintendent of district No. 2 of the Atlantic division, with headquarters at Woodstock, N. B., succeeding R. McKillop, transferred.

As was recently announced in these columns, J. O. Halliday, assistant to the general manager of the New York, New Haven & Hartford, has been appointed superintendent of transportation. There has now been appointed to Mr. Halliday's staff, F. M. Clark, train master as freight assistant; J. E. Clifford as passenger assistant; A. F. Currier, superintendent of car service, and G. H. Staehle, car accountant, both the latter having the same title as heretofore.

Arthur D. Peters, recently appointed superintendent of the Lake Erie & Western, with headquarters at Lima, Ohio, is a native of Springport, Mich., and was born on November 19, 1879. He was graduated from the engineering department of the Michigan Agricultural College in 1903, and entered railway service on February 22, 1906, with the Lake Shore & Michigan Southern. He was a draughtsman until September of the same year, and was in the land and tax department until July, 1911. From July, 1911, to August, 1913, he was real estate agent for the Lake Erie & Western. From the latter date until June, 1916, he was special engineer for that company.

Ritchey E. Landis, whose appointment as superintendent of the Marcus division of the Great Northern has been announced, was born in Blackhawk County, Ia., on December 2, 1870. He was educated in the rural schools of Blackhawk county and at a business college at Waterloo, Ia. He entered the service of the Great Northern in September, 1890, as a freight brakeman and from October 12, 1893, to June 1, 1906, was a freight conductor on the same road. Subsequently, he was a passenger conductor on the St. Cloud and Fergus Falls division. On September 1, 1908, he was appointed trainmaster of the Willmar, Sioux City & Breckinridge division of the Great Northern, remaining in that position until May 5, 1916, when he was promoted to superintendent of the Marcus division, with headquarters at Marcus, Wash.

F. E. Dewey, recently appointed general manager of the Wellsville & Buffalo, with headquarters at Buffalo, N. Y., as has been announced, was born on April 22, 1858, and began railway work as a messenger in the auditor's office of the Central Vermont in February, 1875. He subsequently held various positions on different roads, including that of general superintendent on the New York & New England. In 1898 he was appointed superintendent of the Midland division of the New York, New Haven & Hartford at Boston. He later served as general manager of the Detroit & Lima Northern; general superintendent of the Detroit Southern; superintendent of construction of the Missouri & Arkansas and the Arkansas & Choctaw; also as general superintendent of the St. Louis, Memphis & Southeastern. From October, 1903, to May, 1905, he was vice-president and general manager of the Mobile, Jackson & Kansas City; then to 1906 was vice-president of the Suffolk & Carolina, and later served as assistant to president of the Wisconsin Central.

A. S. Ingalls, recently appointed assistant general manager of the New York Central Lines West, was born on February 27, 1874, and graduated from Harvard University in 1896. He entered railway service in September, 1896, as a clerk in the office of the general manager of the Cleveland, Cincinnati, Chicago & St. Louis. From September, 1897, to January, 1901, he was assistant superintendent of the Cleveland-Indianapolis division and from the latter date until June 10, 1907, was superintendent of the same division. After leaving the Big Four, he became assistant general superintendent of the Lake Shore & Michigan Southern, the Dunkirk, Allegheny Valley & Pittsburgh and the Lake Erie, Alliance & Wheeling, remaining in that position until June 1, 1911, when he was made general superintendent of the same roads. From January, 1915, until May, 1916, he was general superintendent of the third district of the New York Central Lines West with office at Cleveland, Ohio. As assistant general manager he will remain at Cleveland.

Frank M. Smith, whose appointment as general superintendent of the third district of the New York Central Lines West has been announced, was born at Dorset, Ashtabula County, Ohio, and entered railway service on November 14, 1886, as a telegraph operator on the Franklin division of the Lake Shore & Michigan Southern. From April 15, 1893, to December 31, 1897, he was claim agent of the same road at Youngstown, Ohio, and Andover. From January 1, 1898, to January 31, 1903, he was claim agent of the western division of the Lake Shore at Chicago. He then left the Lake Shore and became trainmaster of the Indiana, Illinois & Iowa at Kankakee, Ill., remaining there until February 1, 1905, when he was appointed trainmaster of the western division of the Lake Shore with office at Chicago. From April 24, 1905, to November 24, 1905, he was trainmaster of the Michigan division of the same road at Toledo, Ohio. He was assistant superintendent of the western division with headquarters at Chicago from the latter date until December 1, 1911, when he was appointed superintendent of the same division. He held that position until May, 1916, when he went to Cleveland as general superintendent of the third district of the New York Central Lines.

Traffic

Thomas Waters has been appointed agent of the Star Union Line with office at Duluth, Minn., vice A. F. Ferguson, promoted.

Volney E. Huff has been appointed agent of the Star Union Line at South Bend, Ind., in place of George D. Blair, Jr., resigned.

M. E. Schnell, district passenger agent of the Chicago Great Western at Des Moines, Ia., has been appointed general agent, with headquarters at Fargo, N. D.

Edwin H. Croly, division freight agent of the New York Central and the West Shore at Buffalo, N. Y., has been promoted to assistant general freight agent, with office at Buffalo.

W. B. Knight having resigned, the position of assistant freight traffic manager of the Missouri Pacific-St. Louis, Iron Mountain & Southern heretofore occupied by him, is abolished.

C. F. Woods has been appointed assistant general passenger agent of the New Orleans & Northeastern, the Alabama & Vicksburg, and the Vicksburg, Shreveport & Pacific, with office at New Orleans, La.

L. Bryan has been appointed traffic manager of the Little Rock, Maumelle & Western, with headquarters at 1207 Wright building, St. Louis, Mo., and C. R. Barnett has been appointed general freight agent, with office at Little Rock, Ark.

Engineering and Rolling Stock

Frank C. Worbs has been appointed assistant engineer of the Wheeling & Lake Erie, with headquarters at Cleveland, Ohio, succeeding E. U. Smith, who has left the employ of the company.

S. H. Deacon, master carpenter of the Pennsylvania Lines West at Xenia, Ohio, after a service of 32 years on the Pennsylvania lines retired recently under the pension rules of the company, and is succeeded by W. D. Siegle.

O. H. Attridge, master mechanic of the Atlanta & West Point and the Western Railway of Alabama, has been appointed master mechanic of the Georgia Railroad, with office at Augusta, Ga., vice J. H. Gaston, resigned to go to another company.

Purchasing

E. W. Thornley, district storekeeper of the Pittsburgh district of the Baltimore & Ohio has been appointed assistant general storekeeper and F. A. Murphy, district storekeeper of the Wheeling district has been transferred to the Pittsburgh district succeeding Mr. Thornley, and H. Shoemaker, storekeeper at Newark, Ohio has been appointed district storekeeper of the Wheeling district succeeding Mr. Murphy and C. G. Sutton, storekeeper at Connellsville, Md., succeeds Mr. Shoemaker and W. E. Downing has been appointed storekeeper at Connellsville, succeeding Mr. Sutton.

OBITUARY

Richard Kirkwood, auditor of the Minneapolis, St. Paul & Sault Ste. Marie, with office at Minneapolis, Minn., died on May 28 at his home in St. Anthony Park, Minn.

Charles Hopkins Cartlidge, bridge engineer of the Chicago, Burlington & Quincy, died of pneumonia after a short illness on June 14 at Chicago. He was born at Hannibal, Mo., April 29, 1869. He had a grammar and high school education and began railroad work July 18, 1886, with the Kansas City, Memphis & Birmingham. He worked on construction in Alabama for this road from November, 1886, to June, 1888. From the latter date to January 26, 1890, he was engaged in land surveys and municipal engineering work, at St. Joseph, Mo. On January 20, 1890, he entered the bridge department of the Burlington as draughtsman. He was appointed bridge engineer June 16, 1902. He was also at the time of his death vice president of the Western Society of Engineers.

A Billion Feet of Lumber from California.—A total of more than a billion feet of lumber was sawed by California mills during 1915, according to statistics compiled by the U. S. Forest Service. The report includes figures from 136 mills, thirty-five of which had cut 90 per cent of the total. Of thirteen kinds of wood sawn, redwood led with a total of 418,824,000 ft. b.m. With the exception of about 1,000,000 ft. b.m., it was all California timber.

Equipment and Supplies

FREIGHT CARS

The Chesapeake & Ohio is reported in the market for 1,500 box cars.

The Sumpter Valley Railway is making inquiries for twenty 30-ton freight cars.

The Pennsylvania Railroad is in the market for 5,000 70-ton gondola cars for the Lines East of Pittsburgh.

The Mineral Point Zinc Company, Chicago, has ordered 89 car bodies from the American Car & Foundry Company.

The Chicago, Burlington & Quincy has ordered one scale testing car from the American Car & Foundry Company.

The Northern Pacific has ordered draft sill construction sets for 300 cars from the American Car & Foundry Company.

The Pennsylvania Tank Car Company, Sharon, Pa., recently received an order for 50 steel tank cars from a southern oil corporation.

The Southern Railway has ordered an additional 1,000 box cars from the Lenoir Car Works. This makes a total of 7,350 freight cars ordered by the Southern Railway since March 1, 1916.

The Virginian has ordered four experimental 120-ton coal cars, one each from the following companies: Standard Steel Car Company, Cambria Steel Car Company, Pressed Steel Car Company and Virginia Bridge & Iron Works. The Virginian is also reported in the market for 1,500 50-ton gondola cars.

IRON AND STEEL

The Central of New Jersey has ordered 400 tons of bridge steel from the McClintic-Marshall Company.

The Southern Railway has ordered 500 tons of steel from the McClintic-Marshall Company for an office building at Washington, D. C.

The Pennsylvania Railroad has ordered 150 tons of steel from Lewis F. Shoemaker & Co. and will shortly place orders for 350 tons of steel for six bridges and 300 tons for a subway connection at the New York station.

Russian Government.—A recent item in the Wall Street Journal says: "The Russian Government is quietly trying to place orders for over 300,000 tons of steel rails for delivery in the closing quarter of 1916 and the first quarter of 1917. It is seriously questioned whether these orders will be placed, simply because rail mills are in nearly every case booked up until well into next year, and it is thought improbable that capacity to roll so large a tonnage for export within the required time limit will be found."

The New York Public Service Commission, First District, is asking bids on 50,000 tons of structural steel for use on various portions of the dual system of subways and elevated lines now being built in New York. Bids were received on the unit price basis. The McClintic-Marshall Company, American Bridge Company and the Pennsylvania Steel Company, each was a low bidder on one or more items of the contract. The low bids for the total amount aggregate $3,675,024. No action has yet been taken in awarding the contracts.

Automobile Inspection of Subway.—Citizens in automobiles recently drove under the Harlem river and through a New York subway line. The remarkable feat was made possible by the new Lexington avenue subway and its Jerome avenue branch, which are so far completed that the trip by automobile was possible from 157th street down to Sixtieth street, passing in this trip through the new Harlem river tubes.—*Electric Railway Journal.*

Supply Trade News

George W. Wenz, for several years assistant purchasing agent of the Gould Coupler Company, Depew, N. Y., has been appointed purchasing agent of the company.

The Pressed Steel Car Company has closed a new order for 100,000 shell forgings. These forgings are for 9.2 inch shells and the contract price is said to be in the neighborhood of $2,250,000.

Edward G. Caughey, assistant chief engineer of the Youngstown Sheet & Tube Company, Youngstown, Ohio, has resigned to become general manager of the Pennsylvania Tank Car Company, Sharon, Penn.

Isaac H. Levin, chief engineer and chemist of the International Oxygen Co., has resigned in order to devote his time to chemical research and as a specialist in the electrolytic field with temporary address at 186 Hillside avenue, Newark, N. J.

F. R. Blair, secretary, treasurer and sales manager of the S.K.F. Ball Bearing Company, has resigned to become president of the F. R. Blair & Company, Inc., with office at 50 Church street, New York. It is understood that Mr. Blair is engaged in developing motor efficiency devices.

Charles A. Gross, assistant sales manager, structural steel department of the Bethlehem Steel Company at New York, has resigned from that position to join the Harris-Silvers-Baker Company, New York, engaged in the fabrication and erection of steel structures. This company is being reorganized and it is understood Mr. Gross will be secretary of the new company.

The Canton Foundry & Machine Company, Canton, Ohio, is considering the erection of several large additions to its plant including a new and very much larger foundry and an addition to its machine shop which will increase its capacity about 75 per cent. The company is now building and will have completed in two or three weeks a new shop for the erection and manufacture of portable cranes. This new building will also accommodate the blacksmith department.

Effective June 15, Louis N. McDonald, now superintendent of the Ohio district of the Carnegie Steel Company, which embraces the blast furnaces, Bessemer and open-hearth steel works at the Ohio works, and the upper and lower mills, all in Youngstown; Niles blast furnace at Niles, Ohio; the Greenville bar mills at Greenville, Pa., and the new bar mills at McDonald, Ohio, will succeed John Hughes as assistant general superintendent, J. H. Gross being general superintendent.

G. R. Delamater has been appointed fuel engineer at the Steelton plant of the Pennsylvania Steel Company. He will be in charge of all coal washings; the supervision of the coal stock, including coking, bituminous, gas, slack and anthracite coal, coke breeze and the disposition of these products to the various departments; sampling of coal; the deliveries of gas, tar, coke and coke breeze, and miscellaneous matters between the various operating departments and the Semet-Solvay Company.

On June 6, the stockholders of the Barney & Smith Car Company, Dayton, Ohio, elected as directors A. Clifford Shinkle, Lawrence Maxwell, Charles L. Harrison, Edward L. Heinsheimer, and H. W. Lithmann, of Cincinnati, Ohio; Eugene J. Barney, H. M. Estabrook, A. J. Stevens and J. S. Kiefaber, of Dayton. The new members, Messrs. Shinkle, Lithmann and Heinsheimer succeed James L. O'Neil of Pittsburgh, and E. L. Potter of New York, retired, and John Ledyard Lincoln of Cincinnati, deceased.

The executive departments of the Western Electric Company, Incorporated, at New York were moved on June 5 from 463 West street to new offices in the Telephone and Telegraph Building at 195 Broadway. The move was made necessary by the steady growth of the company's engineering departments which will occupy the space that has been vacated. The change also brings the executive departments in closer touch with the heart of New York's business district. The local New York distributing department and the engineering and patent departments remain at

P. J. Ford, for years buyer and department manager for Crerar, Adams & Company of Chicago, has organized the P. J. Ford Company with office and store at 619-621 West Washington street, Chicago, and has the selling agency for the Ford Chain Block and Manufacturing Company of Philadelphia, the Indiana Foundry Company, Ltd., of Indiana, Penn., manufacturers of the Sutton sand drier, and several heavy hardware specialties in the railroad supply field. Mr. Ford is president and treasurer of the new company and is a man of long experience in the railway supply field. A native of Chicago, he entered the employ of Crerar, Adams & Company as assistant shipping clerk on June 26, 1883. He remained in that position for three years, was shipping clerk for two years, and subsequently city buyer for five years. For the past twenty-three years he has been buyer and department manager of that company.

TRADE PUBLICATIONS

Expansion Joint.—Catalogue "A," recently issued by the Ross Heater & Manufacturing Company, Buffalo, N. Y., illustrates and describes the Ross crosshead-guided expansion joint for high and low pressure steam, oil, gas and water piping.

Electrical Apparatus.—Among recent publications of the Sprague Electric Works, New York, are Bulletin No. 49600 relating to flexible steel armored conductors, flexible steel conduit, stamped steel boxes and fittings and tools, and Bulletin No. 48907 dealing with the company's 500 lb. electric hoists, type I-5.

Train Control.—The Miller Train Control Corporation, Staunton, Va., has published a 16-page booklet entitled, "Miller Train Control," which includes a brief resumé of the development of this device, a description of its operation, a record of its installation and the service which it is rendering on the Chicago & Eastern Illinois and a brief comment on the place of the automatic stop in modern railway operation. The booklet is handsomely bound in black leather and artistically illustrated.

Storage Batteries.—The Edison Storage Battery Company has prepared a new booklet on its storage battery, and this was distributed the first day of the M. C. B. convention. This booklet is considerably more elaborate than any issued in the past. It is profusely illustrated, and contains a simple and concise explanation of the chemical action taking place in the Edison battery on charge and discharge. It also gives complete data on train lighting batteries, which will be of interest to railroad officers.

Southern Railway.—One of the recent publications of the passenger department of the Southern Railway is entitled Camping on Mount Mitchell. The booklet contains information regarding places for summer camps in United States forests in North Carolina. It not only treats of the excellencies of this region as a camping country but gives interesting information concerning camp food, outfits and cooking, camp clothing and other suggestions, and the prevention of forest fires. The booklet is well illustrated.

Graphite for Cylinder Lubrication.—A booklet recently issued by the Joseph Dixon Crucible Company, Jersey City, N. J., bears the title of "Graphite for Cylinder Lubrication." The booklet tells of graphite lubrication for both steam and gas cylinders and gives facts about lubricators made by various companies to use graphite alone or with oil. Data is given also concerning the saving possible with graphite lubrication, a saving of 50 per cent being asserted as possible with the proper use of flake graphite lubrication.

Potentiometer System of Pyrometry.—This is the title of a booklet recently issued by the Leeds & Northrop Company, Philadelphia. The potentiometer pyrometer is based upon the use of the thermocouple, but differs from the ordinary deflection galvanometer or millivoltmeter pyrometer in that the electromotive force resulting from the difference in temperature between the hot and cold ends of the thermocouple is measured by a novel balancing method rather than by a deflecting galvanometer. The potentiometers employed are of two general types, hand adjusted indicators and automatically adjusted recorders. The recorders are of the single-point curve-drawing class and of the multiple-point printing class, the latter being supplied for keeping records of the temperatures of as many as 16 different thermocouples.

Railway Construction

BOSTON & ALBANY.—This company has let a contract to the Hugh Nawn Contracting Co., Boston, Mass., for third track work from Payn's, N. Y., just east of Chatham to Cady's, about 2.25 miles. This new track will be an important link of the Boston & Albany eastbound third track, giving a continuous eastbound freight track from Payn's to West Pittsfield, Mass.

GREAT FALLS & TETON.—This company, a subsidiary of the Great Northern, has awarded a contract to A. Guthrie & Co., of St. Paul, Minn., for the construction of a nine-mile line from Bynum, Mont., to Pendroy, at an estimated cost of $190,000.

INTERSTATE TRANSFER.—This company will extend its lines from South Itasca, Wis., to the entrance of the harbor at Superior Bay, 4.8 miles. The company is doing the work with its own forces. H. L. Dresser, chief engineer, 401 Wolvin building, Duluth, Minn.

MCCONNELLSBURG & FORT LOUDON.—Bids are wanted by this company for building a railroad from McConnellsburg, Pa., to Fort Loudon, about 11 miles. The plans call for 100,000 cu. yd. of excavation work; the maximum grade is 6½ per cent, and the maximum curvature 18 deg. The principal commodities the road will carry are coal, iron ores, slate, silica sand, gannester rock, timber, ties and farm products. John P. Sipes, president, McConnellsburg, Pa. (June 11, 1915, p. 1265.)

ORLEANS-KENNER ELECTRIC RAILWAY.—Surveys are now being made, it is said, for a six-mile extension, to be build from Hanson City, La., west to Rost. The estimated cost of the proposed extension is about $100,000. The company now operates a line from New Orleans west to Hanson City, 12.5 miles.

OROGRANDE, NEW MEXICO.—In order to provide a transportation outlet for its iron mine situated four miles from Brice, N. M., the Colorado Fuel and Iron Company is constructing a short line railway from the end of the Orogrande branch of the El Paso and Southwestern to its property.

SALINA NORTHERN.—This company is building an extension 55 miles long, from Lincoln Center, Kan., northwest. The work involves 850,000 cu. yd. of fill, 285,000 cu. yd. of cut, 25,000 cu. yd. of rock excavation, and the erection of one 55-ft. deck girder span, three 67-ft. through girder spans and four 120-ft. pin connected truss bridges. Twenty-five hundred cubic yards of masonry will be placed and 6,400 lineal ft. of trestles erected. W. H. Cost, chief engineer, Salina, Kan.

SAN DIEGO & SOUTH EASTERN.—This company will rebuild a section of its line across the Sweetwater Valley between National City, Col., and Chula Vista. The project calls for a fill of about 12,000 cu. yd., the laying of about 4,000 ft. of track, and the construction of three small pile bridges. The total cost of the work has been estimated at $22,000.

SAVANNAH RIVER TERMINAL COMPANY.—This company has been granted a franchise to build a connecting line in Augusta, Ga., from the Augusta & Summerville Railroad to the city wharf, and also a connection with the Charleston & Western Carolina Railway. The grading work will be very slight, and curves will not exceed 20 deg. Work will be done by company forces and will probably be completed within nine months. The line will be used principally for switching purposes and for hauling all locomotives. Charles A. Wickersham, president.

SCOTT & HOWE LUMBER COMPANY LINE.—This company will build a logging railroad from Hurley, Wis., six miles, into its timber holdings. About four miles are expected to be completed by December. The road will be built by company forces.

ST. JOHN & QUEBEC.—The legislature of New Brunswick has just passed a bill providing for the construction of two extensions of the St. John Valley. This railway is now operated by the government for a distance of about 120 miles, between Centerville, N. B., and Gagetown, a point about 25 miles south of Fredericton. One extension is to be completed in the early part of 1917 from Gagetown about 45 miles southwest to Westfield, whence connection will be made over the Canadian Pacific into the city of St. John. The contract for this section has just been awarded to the Nova Scotia Contracting Company, Halifax, N. S. A later extension provided for in the bill is to be built north from Centerville to Andover, about 20 miles; the lines will be almost parallel with the eastern boundary of Maine, and about 8 miles east thereof. (June 2, p. 1205.)

ST. JOHN VALLEY.—See St. John & Quebec.

SAN PEDRO, LOS ANGELES & SALT LAKE.—Improvements in roadway to be carried out during the present season will aggregate in cost about $1,318,000. Of this sum, $547,000 will be spent for new rails of 90 lb. section; $260,000 for bridges and $511,000 for miscellaneous improvements.

THE WICHITA (KAN.) TERMINAL.—This company will extend its line one and one-half miles to serve the Wichita Terminal Elevator Company. It is estimated that the project will cost about $27,000.

RAILWAY STRUCTURES

BALTIMORE, MD.—The construction of new freight tracks of the Baltimore & Ohio over the Key highway will require four bridges across the street, two to be built by the city of Baltimore, and two by the railroad company.

BOSWELL, PA.—The Johnstown & Somerset Railway has given a contract to the Phoenix Bridge Company for building a 650-ft. viaduct, which will consist mostly of 60-ft. spans. The viaduct is to be built over Quemahoning creek and the tracks of the Baltimore & Ohio.

CANTON, OHIO.—The Wheeling & Lake Erie will build a three-story, reinforced concrete freight house, 40 ft. by 360 ft., at a cost of about $90,000. About 1½ miles of track is also being laid, involving 45,000 cu. yd. of grading, the placing of 2,300 cu. yd. of concrete, and the erection of three bridges 118 ft., 109 ft. and 93 ft. long respectively. J. C. Carland & Co., Toledo, Ohio, have the contract for the track work.

CUMBERLAND, MD.—The Baltimore & Ohio will remodel its old enginehouse at Cumberland for use as an erecting shop, at a cost of about $20,000.

FREWSBURG, N. Y.—The New York Central will build a bridge over Conewango creek at Frewsburg to consist of two 100-ft. through girder spans. It is expected that the Pennsylvania Steel Company will be given the contract for the work, which is to cost about $4,600.

GREAT FALLS, MONT.—The Great Northern has awarded a contract for the construction of a 20-stall brick roundhouse, a powerhouse and a 100-ft. turn table to Grant Smith & Company, Seattle, Wash., and a contract for a 500-ton coal chute to the Howlett Construction Company, Moline, Ill. The work is now under way.

JAMESTOWN, N. D.—The Northern Pacific has awarded a contract to the E. G. Evensta Construction Company, Minneapolis, Minn., for the erection of a passenger station.

LOS ANGELES, CAL.—The Board of Public Utilities of this city has endorsed the report of its committee of engineers relative to the elimination of grade crossings, and has requested the state railroad commission to join it so that there will be no subsequent clash as to jurisdiction. The report recommends the partial depression of the Atchison, Topeka & Santa Fe and San Pedro, Los Angeles & Salt Lake tracks, and the partial elevation of Main, Macey, First, Fourth, Seventh and Ninth streets.

MANCHESTER, N. Y.—The present inadequate engine handling facilities of the Lehigh Valley at Manchester will be replaced with a 30 stall roundhouse, for which contract has been let to Westinghouse Church Kerr & Co., New York. The company will also carry out improvements, including the construction of a new machine shop, boiler, engine and oil houses and an office building. In addition the plans call for a considerable adjustment of track arrangements. A concrete and steel water ash pit, double tracked and 350 ft. long will be built and a concrete gravity coal trestle with a capacity of 1,250 tons will be installed, also a 100-ft. turntable and special electrical apparatus will be provided to operate all of the machinery and light the yards.

There will also be a large compressor layout for supplying air throughout the yards for testing purposes.

New York.—The Public Service Commission for the First district has awarded the contract for the construction of stations on sections Nos. 12 to 15 of route No. 5 of the Lexington Avenue subway to A. W. King & Co., the lowest of six bidders, at $316,091.06. The stations to be finished are 110th Street, 116th Street and 125th Street (express) on the main line; Mott Haven, 149th Street (express) on the Jerome Avenue branch, and Third Avenue (express) on the Southern Boulevard branch. The contract now goes to the Board of Estimate and Apportionment for approval. The work is to be completed within six months from the delivery of the contract.

The New York Public Service Commission, First district, have invited bids for the construction of an elevated railroad yard consisting of an embankment, the embankment being confined on the west, south and part of the east sides by retaining walls. The yard will have a capacity of 275 cars and is to be completed within a year after the contracts are awarded.

Niagara Falls, N. Y.—Terminal improvements are to be carried out by the Lehigh Valley at Niagara Falls, to include a new 15-stall roundhouse, machine shop, storehouse, engine, boiler and oil house; an office building, and a new freight station will also be built. The contract for building the roundhouse has been let to Westinghouse Church Kerr & Co., New York. A considerable addition to the yard tracks will be made and a new car repair yard with necessary shops and storehouses will be built. The new roundhouse will be of modern type and will be of steel and reinforced concrete construction. The improvements include drop pits and a washout system for cleaning engines, a concrete and steel water ash pit, double tracked and 250 ft. long and a concrete and steel coal pit 200 ft. long with elevated tracks. A 100 ft. turntable will also be built. The new freight station and the necessary yards will be located near Suspension Bridge, north and east of the present yards used by the Lehigh Valley. The building will be a two-story structure of hollow-tile concrete and steel construction, the second floor is to be used for offices. The freight house will be 133 ft. by 143 ft. and concrete platforms will flank it on either side.

Parkersburg, W. Va.—The Baltimore & Ohio has plans made for new freight facilities to be constructed at Parkersburg, W. Va., at a cost of $300,000. Work will be started as soon as the contract is let on a modern freight station, transfer platform, team tracks and offices for the division freight and the agency forces. The building, which will be located at the corner of Fourth and Avery streets, will be of brick construction, 500 ft. long by 35 ft. wide, with the office portion of the building occupying the second story. The office entrance will be on Fourth street by means of a bridge across the driveway, which is 12 ft. lower than the street. In addition to a platform 8 ft. wide running the full length of the building, the transfer platform, which will also run the full length of the building, will be 15 ft. wide. The tracks will have a capacity of 60 cars at the freight house.

Pittsburgh, Pa.—The Baltimore & Ohio will soon award the contract for the erection of a new freight house at Thirty-third street, Pittsburgh. The structure will be 350 ft. long by 35 ft. wide, and have a steel frame. The tracks will have a capacity of 27 cars, in addition to which the three-team tracks will have a capacity of 25 cars.

Portland, Ore.—Plans have been filed with the city authorities providing for the elimination of grade crossings on the Oregon-Washington Railroad & Navigation Co.'s line in Sullivan Gulch. The work projected includes the construction of seven permanent and three temporary viaducts. The estimated cost of the structures is $520,000, and of the entire project about $600,000. Sixty per cent of the cost will be assessed against the street railway company and the Oregon-Washington Railroad & Navigation Company. Legal procedure does not permit the asking of bids before the latter part of September or the first of October.

Pottstown, Pa.—The Philadelphia & Reading has given a contract to P. J. Campion, Mahonoy City, Pa., for the concrete foundation and to the American Bridge Company, Philadelphia, for fabricating and erecting the steel superstructure of a bridge to be built over Keim street, Pottstown. It will be a one span, 40 ft. clear through plate girder structure with solid floor.

Railway Financial News

Central Vermont.—The action of the Massachusetts legislature, noticed in the *Railway Age Gazette* June 9, page 1231, giving this company powers in connection with the New London Northern, is subject to approval by the Public Service Commission of that state, after a public hearing. The legislative act provides that the Central Vermont may assign its interests in the New London Northern, and may acquire the stock of the Southern New England. The Central Vermont, for the purpose (a) of paying its bonded indebtedness of $12,000,000, maturing in 1920, and other indebtedness incurred for improvement and equipment; (b) to complete the Southern New England, and (c) to pay for other future improvements, is negotiating with New York bankers for new bonds to the aggregate amount of $30,000,000. The proposed improvements cannot be undertaken until the funds are secured through new bonds, to be issued under a mortgage, and in order that the bonds may be disposed of the leasehold interest of the Central Vermont in the New London Northern must be subjected to the lien of the proposed mortgage. The attorneys for the New York bankers required the consent of the Massachusetts legislature to the assignment of that leasehold interest, and the legislature hurried the bill through under a suspension of the rules. The Central Vermont will pledge all its New England property, including the stock of the Southern New England and the leasehold interest in the New London Northern, and the bonds will be guaranteed by the Grand Trunk. The New London Northern is that section of the Central Vermont system extending from Brattleboro, Vt., southward to New London, Conn., 121 miles. At Palmer, Mass., about half way from Brattleboro to New London, the Southern New England, not yet finished, branches off toward Providence.

Chicago, Indianapolis & Louisville.—The directors have declared a dividend of 3¼ per cent. No dividend was declared last year or in the previous year but prior to 1914 regular dividends, of 1⅝ per cent semi-annually (3¼ per cent a year) were paid on the common stock. The Southern Railway and the Louisville & Nashville own each a half of the majority (93 per cent) of the $10,500,000 common stock of the Chicago, Indianapolis & Louisville.

Lorain, Ashland & Southern.—The Lorain, Ashland & Southern, built by Joseph Ramsey, Jr., has been sold to the Pennsylvania. The road is 68 miles long, and its purchase will give the Pennsylvania entrance to an additional Lake Erie port, and to the plant of the National Tube Company at Lorain.

Louisville & Nashville.—See Chicago, Indianapolis & Louisville.

St. Louis & San Francisco.—The Public Service Commission of Missouri on June 5 approved the plan of reorganization of the St. Louis & San Francisco as submitted by the reorganization committee in New York, with the exception of the voting trust feature, which will probably be taken to the Supreme Court. Chairman Busby of the commission gave out the following statement: "The reorganization of the Frisco Railroad Company has been authorized by the unanimous vote of the Missouri Public Service Commission. The reorganization, which has been approved by the commission, conforms in all respects to the former ruling of the commission, with the exception of the voting trust, which the commission still holds to be illegal. But inasmuch as all the interested parties have agreed upon the terms of reorganization, the legality of the voting trust is left by the commission to be determined by the courts. The effect of the commission's ruling, if accepted by the reorganization managers, will be the reincorporation and reorganization of the Frisco Railroad Company under the laws of the state as a Missouri corporation."

Southern Railway.—In regard to additions to "Other Income" this year see Chicago, Indianapolis & Louisville above.

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WE GUARANTEE that of this issue 12,715 copies were printed; that of these 12,715 copies, 11,244 were mailed to regular paid subscribers to the Railway Age Gazette and the Railway Mechanical Engineer; 171 were mailed to advertisers, 300 were provided for counter and news companies' sales, new subscriptions, bound volumes, copies lost in the mail and office use; and 1,000 copies for distribution at Atlantic City.

THE RAILWAY AGE GAZETTE is a member of the Audit Bureau of Circulations.

Dismantling Freight Cars

It has been a pretty general belief in railway circles that there is no economy in any attempt to save much of the material from old freight cars for future use. The general idea has been that it costs more to dismantle the cars than the material which is saved is worth and following the tendency toward which such an idea generally leads, it has been common practice to burn the bodies of obsolete freight cars. Quite recently, however, the work of dismantling old cars has been given more serious attention and it has been demonstrated that where they are collected in sufficient numbers it is distinct economy to dismantle them rather than to burn them. The lumber, if removed with sufficient care, can for the most part be used for other purposes. The sheathing can be satisfactorily used for roofing and the sills for foundation work and the framing of buildings, while the decking makes good platforms. On the Southern Railway, where considerable of this work has been done, it is stated that a saving is realized simply because of the bolts, nuts, washers, etc., being in better condition than when the car is burned and, furthermore they are already sorted and classified. There are also numerous other ways of using the scrap lumber, such as side doors for gondola cars, grain doors, etc. This is a phase of the work of reclaiming material which is well worth looking into by more of the large roads, but as we have pointed out before in connection with reclamation work it should be investigated impartially in every case to make sure that it actually pays.

Draft Gear Capacity

Perhaps the most interesting lesson to be learned from the report of the Draft Gear Committee this year is the necessity of having sufficient draft gear capacity. Comparing the same draft gears on sills of different cross-sectional area it will be seen that with gear *A* the sills show a permanent set at 12,500 ft.-lb. on the small sills and 15,000 ft.-lb. on the large sills, or an increase of only about 20 per cent in foot-pounds and 60 per cent in cross-sectional area. This gear was the only spring gear used in the tests. The same is true of the friction gears. Take gear *C*, for instance. On the small sills 32,500 ft.-lb. was obtained, whereas on the large sills only 35,000 ft.-lb. was obtained, or an increase of eight per cent. It will also be noticed that regardless of the cross-sectional area of sills there is but very little difference between the amount in foot-pounds when the gear goes solid and when permanent set is found to obtain, all going to show that regardless of the size of the center sill it is necessary to have a draft gear of sufficient capacity to absorb the shocks received in service. The suggestions offered by the members to be considered in future investigation of the work of this committee would serve to give much interesting information, and it is to be hoped that the committee will have an opportunity to act on these suggestions.

The Standard M. C. B. Coupler

With the final recommendation of a standard coupler the Coupler Committee practically finishes a task which has required five years of arduous work and experimentation and involved an expenditure of some $300,000, of which it is estimated that the manufacturers have contributed $200,000 and the railroads $100,000. R. L. Kleine, chairman of the committee, is to be congratulated upon the very thorough and scientific manner in which the committee work was conducted. He has had a peculiar and somewhat difficult task to perform, and one in which diplomacy and absolute fairness has made it possible for the results to be accomplished with no friction between the committee and the manufacturers. The records of every test and all the specimens tested are filed for future reference if any questions should arise regarding the work the committee has done. The words of the association in receiving this report indicate highest appreciation for what the committee has done. The actions of the members, however, should follow their words. They should take the coupler, put it in service on as many cars and locomotive tenders as they can and give the results of the service trials to the committee for future development of the work. It is only by this coöperation that it will be possible to make this large and expensive work worth while.

Rehabilitation of Freight Cars

Where should the line be drawn between rebuilding or scrapping freight car equipment? Many factors enter into the proper solution of this problem. In the first place, traffic conditions must be carefully and thoroughly studied. A 34-ft. low, narrow box car, for instance, is useless for general service; likewise, except in special cases, cars of low capacity cannot be operated economically. It is the practice on several roads to destroy cars which fall below the traffic requirements when they are in need of heavy repairs. The second important consideration is the amount of money it is desirable to spend on cars which can be strengthened and improved to meet modern conditions of service and be practically as good as new after such repairs and alterations are made. A wooden box car of standard dimensions, for instance, may be reinforced by adding a steel

subframe, including metal bolsters, under the wooden sills; supplying a new draft gear; building a new roof, and possibly adding a steel end and replacing the old door fixtures with wooden ones which are burglar-proof and prevent moisture and cinders from entering the car. Some roads are spending as much as $600 to $650 and even more, on wooden box cars in this way and have proved that the investment is a wise one. No rules which are generally applicable can be laid down to define the critical point between rebuilding and scrapping equipment. Local traffic conditions, the peculiarities of the equipment and the financial condition of the road all have a bearing on the question. Much money may be wasted by indifference or lack of care in studying these conditions, and deciding upon their relative importance in solving the problem. Preferably, the subject should be investigated by a committee on which the traffic and operating departments are represented, as well as the motive power and car departments. The question cannot be settled satisfactorily in an off-hand manner.

The Wheel Committee Report

The report of the Committee on Car Wheels and the discussion which took place, considered with the position of the manufacturers of chilled car wheels, indicates a considerable variation in opinion as to the need of thickening the flanges of cast iron wheels. Both the committee and the manufacturers bring out points which seem eminently reasonable, but the committee considers the present thickness of flange sufficient, while the manufacturers contend for a great thickness of metal at this point and base their arguments purely on the desire for a stronger and better wheel. The decision of the committee on the matter of flange thickness might easily be construed as a compliment to the wheel manufacturers as it says in effect that this part of the wheel is now strong enough, but the matter of the strength of the plate is still under consideration and in fact the design of the entire wheel is being gone into so that, as brought out by O. C. Cromwell, the flange thickness is only a part of the entire matter. Taken altogether, there would seem at present to be such a conflict of opinion as to make it advisable for the committee and the manufacturers to co-operate to the fullest extent in the entire matter of cast iron wheel design. The stand that the manufacturers take is a strong one, being made from the position of a stronger and a better wheel, but it is hard to believe that the committee is not as fully alive to the importance of the matter of strength as the manufacturers. There are a number of points that need settling and the best results can be obtained by all concerned co-operating to arrive at the best all-around design of wheel. The manufacturers have a great deal of data on the subject which should be valuable to the wheel committee and with both the manufacurers and the committee bent on obtaining the best, safest and most serviceable wheel possible it should not be difficult for them to get together and through this co-operation to arrive at the desired result.

THE WEIGHT OF STEEL PASSENGER CARS

THE Pennsylvania Railroad steel coach, class P-70, with a weight of 120,000 lb. and a seating capacity of 88 passengers, still retains the lead from the standpoint of low dead weight per passenger among through line coaches. This car, which was practically the first design used for steel passenger equipment to any great extent, weighs 1364 lb. per passenger. It is mounted on four-wheel trucks which, of course, gives it an advantage over those cars which are equipped with six-wheel trucks. The Boston & Maine has recently placed in service some steel coaches which have the same weight and carrying capacity as the Pennsylvania cars. These are also mounted on four-wheel trucks.

For the most part, cars which are mounted on six-wheel trucks run well over 1400 lb. per passenger and the New York Central coach with a total weight of 142,000 lb. and a seating capacity of 84 runs as high as 1690 lb. This car has a number of features which the road does not feel should be omitted; for example, double windows, which contribute toward a substantial increase in the weight, and it is mounted on six-wheel trucks. The weight of some steel cars on the Central Railroad of New Jersey which are mounted on four-wheel trucks run as high as 1480 lb. per passenger, the total weight being 115,800 lb. and the seating capacity 78. The New Haven is operating coaches seating 88 passengers and weighing 131,000 lb., the trucks being of the six-wheel type; the dead weight per passenger in this case is 1488 lb., which is very little more than the Jersey Central car. We believe that the latter has wooden interior finish, which in all probability accounts for some of the extra weight.

With the exception of the Erie suburban cars which seat 86 passengers and have a dead weight per passenger of 1109 lb. there does not seem to be any car of recent design now in service which improves on the figures for dead weight given above for the Pennsylvania and the Boston & Maine car. While, of course, the old wooden equipment did not provide nearly the equivalent strength of the present-day steel car, it was possible to obtain a lighter weight per passenger carried and considering this and the figures obtained in the case of the Pennsylvania and Boston & Maine cars, it seems more than likely that by eliminating some of the features which produce weight without adding to the car's strength there could be more accomplished toward reducing the weight of passenger trains than seems to be generally the case. Anything that can be accomplished in this direction will be of material assistance to and greatly appreciated by the locomotive designer.

WHY THE ELECTRICAL DEPARTMENT

ELECTRICAL work on steam railroads was, until a few years ago, considered of secondary importance, and at best only a necessary evil. It is today, however, being recognized for its true value, and on some roads the electrical department is being given its proper position in the railroad organization. On roads having an appreciable amount of electrified line, this is, of course, necessarily true, but even on roads that have no electrified section whatever the importance of the electrical department should not be under-rated.

The operation of electrical equipment is radically different from that of mechanical equipment, in that it is of a rather intangible nature, and this fact makes it all the more necessary that a high-grade, competent man be placed in charge rather than subordinating this office, as is done on some railroads today.

When mechanical equipment is neglected, due to carlessness or incompetence, the equipment itself soon tells the story with hot or worn bearings, an engine going along on three legs, flat wheeled cars, etc.; but when electrical equipment is neglected it may run for many months apparently in good condition, but at the same time burning the heart out of the insulation of an overworked motor, slowly boiling the active material out of the battery plates—the very life of the storage battery itself; the collection of dust on the armature, etc., until some day one armature after another fails; a $500 storage battery is found to be a wreck at the end of its first year, or a heavy arc flash-over turns an armature into an electric furnace.

Although this is sometimes due to the usual causes of carelessness and incompetence, it is far too often found to be

the case that the head of the electrical department has either no direct jurisdiction over the men who actually maintain the electrical equipment or has not sufficient appropriation to hire competent men; or a situation that is worse, the salary allotted to the position of the electrical department head is not attractive to a really competent man nor sufficient to hold a capable man after he has become equal to the occasion.

The operation of electric car lighting equipment probably offers one of the best illustrations of the importance of having ample supervision and competent men. Assume that a road operates 300 axle lighted cars. The electrical equipment involved costs approximately $1,500 per car—a total of $450,000, but of this equipment practically $800 per car—$240,000 total—is of such a nature that by careless maintenance or operation it can be permanently destroyed in one year or less.

On the other hand, if by more efficient organization and co-operation all along the line in maintaining proper lamp voltage regulation a saving of but two lamps per car per month can be effected, a saving of $150 per month, or $1,800 per year, will result. Again, if by careful battery maintenance an average battery life of four years can be extended to six years—which is not at all unreasonable—the saving, assuming a battery cost of $400, will be as follows:

Depreciation four-year life	$100.00
Depreciation six-year life	66.66
Annual saving per car	$33.34
Total annual saving	$10,000.00

Again, if by having an organization trained to carefully watch axle generator belts so as to locate a cracked or a torn belt, a generator out of alignment, etc., so as to anticipate a belt failure before it actually occurs, and a saving of but one belt per year is made, this will represent a money saving of about $5 per year, or $1,500 total. Summarizing these three items alone:

Saving on two lamps per car per month	$1,800.00
Extending life of batteries two years	10,000.00
Saving one belt per car per year	1,500.00
Total saving by proper supervision on 300 cars	13,300.00

In this comparison we have selected only three items in but one branch of the work of the electrical departments, but this same reasoning can be extended so as to include other lines, such as proper selection of electrical equipment to best meet the requirements and with the greatest economy. It is then not difficult to understand how a saving of $100,000 per year in the electrical department of a road of this size might be effected simply by a proper organization and efficient management. In many cases inefficient and unreliable electrical equipment has been purchased without approval of a competent man who should also supervise its installation.

It should be pointed out, however, that this saving can be made only where a competent man of ideas is in charge—and competent men can be obtained or retained in their present position only by giving them a salary somewhat commensurate with the savings they effect. Where the electrical department is too much subordinated to other departments, as the situation exists on many roads to-day, the officials are too prone to look at electrical matters from the mechanical viewpoint, with the result that some of the purely electrical considerations of highest importance may be overlooked. The ideal situation would be to have the electrical department independent of other departments, with supervision over design, installation and operation of all electric equipment.

The American railroads buy approximately $50,000,000 of electrical equipment annually. Surely the dignity, authority and salaries in the electrical department should be somewhat commensurate with the value of the equipment involved. This must be so if the highest return on the investment is to be obtained.

TO-DAY'S PROGRAM

Discussion of reports on:

Tank cars	9.30 A. M. to 10.00 A. M.
Specifications and tests for materials	10.00 A. M. to 11.00 A. M.
Welding of truck sides and bolsters	11.00 A. M. to 11.30 A. M.
Unfinished business; reports of committees on correspondence, resolutions and such other committees as may be named during the convention	11.30 A. M. to 11.34 A. M.
Election of officers	11.45 A. M. to 1.30 P. M.

ENTERTAINMENT

10.30 A. M.—*Orchestral Concert.* Entrance Hall, Million-Dollar Pier.

3.30 P. M.—*Orchestral Concert and Impromptu Dancing.* Entrance Hall, Million-Dollar Pier.

9.30 P. M.—*Carnival Dance.* The program will contain the usual carnival features; streamers, horns, balloons, ticklers, whistles, fancy caps, etc. Special Features. Ball Room, Million-Dollar Pier. Don Richardson New York Orchestra.

RAILWAY CLUB SECRETARIES

Harry D. Vought, secretary-treasurer of the Society of Railway Club Secretaries, announces that a meeting will be held Saturday morning at 10 o'clock in room 193 of the Blenheim.

PURDUE DINNER

The annual Purdue Alumni dinner will be held at the Shelburne Hotel on Saturday evening at 6.30. All Purdue men should be there. See E. E. Silk, John Neff or L. E. Endsley, or register at the Railway Review space and let the committee know at once if you can be there.

ROLLER CHAIRS FREE

J. L. Randolph, chairman of the Transportation Committee, has asked the *Daily* to emphasize the fact that the roller chairs are free, not only to members but also to their friends wearing badges. Many, it is said, are walking because they do not understand this.

COMMITTEE ON OBITUARIES

The following members were named as Obituary Committees: For W. H. Dunlap, C. F. Giles; for N. L. Friese, W. K. Carr; for H. L. Lewis, J. H. Manning; for James Markey, J. W. Taylor; for J. F. DeVoy, A. E. Manchester; for J. W. Hogsett, George McCormick; for J. P. McCuen, W. H. Dooley; for D. F. Knapp, T. W. Heintzleman, and for B. E. Merwin, J. W. Taylor.

CORNELL ANNUAL DINNER

Following their usual custom, Cornellians attending the Master Car Builders' and Master Mechanics' Association conventions at Atlantic City will meet for their eleventh annual banquet next Saturday evening at 7.30 at the Hotel Traymore. Professor Wells, of "Sibley," and "Jack" Moakley, coach of Cornell's victorious intercollegiate track team, will be the speakers of the evening. It is also expected that Professor Carpenter will be present.

It is requested that all Cornellians who have not already signified their intention of being present will communicate with Arthur S. Lewis, '03, who is located at the exhibit of the Chicago-Cleveland Car Roofing Company, space No. 514 on the convention pier.

LEAP YEAR CARNIVAL DANCE

This evening's entertainment will be featured as a carnival dance, the event which was so successful last year. To night at 9.30 is the time and the Million-Dollar pier is the place. The program will include the usual carnival features—streamers, horns, balloons, ticklers, whistles, fancy caps, etc. The Richardson orchestra will play, and the management will be in the hands of a committee of ladies headed by Miss A. Gertrude Hogan, Mrs E. W. Pratt and others.

TWO FORMER ERIE CAR BUILDERS PASS AWAY

Within the past few days two men formerly at the head of the car department of the Erie have passed away. Tuesday morning Robert Gunn died at Hamburg, N. Y., and last Sunday E. A. Westcott passed away at Chicago.

Mr. Gunn was 76 years of age and was in the employ of the Erie for 55 years. He entered the service as an employee in the Salamanca, N. Y., shops. Later he was placed in charge of the Buffalo car shops and was promoted to the position of master car builder. At the time of his death he was consulting engineer of car construction. Mr. Gunn is survived by a widow and two sons, one of whom is in the employ of the Erie.

Mr. Westcott was also a consulting engineer of car construction. He was about 65 years of age and for the past 15 or 18 years has been with the Erie. He was master car builder before being made consulting engineer of car construction. His son J. Westcott is with the Q. & C. Company.

MR. BRAZIER MISQUOTED

Between the difficulties which the stenographers have in securing correctly the remarks of some of the speakers and the mistakes which are likely to occur in transcribing and editing the notes and getting them through the print shop, errors sometimes occur even in the *Daily*. For instance, F. W. Brazier, of the New York Central, was badly misquoted in the report of the discussion of the Brake Shoe and Brake Equipment Committee report on page 1295 of yesterday morning's *Daily*. What he intended to say was that his system believed in using strong safety hangers attached inside the channel instead of outside as shown in the illustration which accompanied the committee's report. His system has experienced considerable trouble because of the hanger bolts working out. Even where double nuts are used he believed it advisable to go a step further and use a spring cotter. Within the past few months there have been several instances where brake beams have dropped down. On over 60 per cent of the New York Central equipment the safety device is so placed that in case of the hanger breaking the beam cannot drop to the ground.

RAILWAY ELECTRICAL ENGINEERS' CONVENTION

The semi-annual convention of the Association of Railway Electrical Engineers is to be held at 9.30 a. m. Friday, the 16th, Hotel Dennis. Of the various committee reports to be presented those on Illumination, Train Lighting Equipment, Shop Electrical Practice, Anti-friction Bearings for Motor Equipment and Standardization of Crane Motors are of special importance.

On account of the radical change in the manufacture of high efficiency incandescent lamps, the former basis of rating lamps has been found to be inadequate. Therefore, the committee finds it necessary to advocate a change in the basis of rating lamps to the mean spherical candle power and lumen basis instead of wattage as formerly.

The committee on shop practice has outlined a comprehensive report to be considered at the time of the annual convention, including practice on electric arc welding, maintenance and repairs, and compressed air and its application, the latter including a consideration of electric driven tools versus air driven tools for special conditions in railroad shops.

Anti-friction bearings for motor equipment will occupy a large part of the attention of the convention. The very satisfactory operation of anti-friction bearings on axle lighting generators and a considerable experience with the use of anti-friction bearings in motor service forms the basis of a movement to bring about a general use of anti-friction bearings on motor equipment in use on the railroads. This committee is co-operating with the General Engineering Committee of the Electric Power Club, which represents all of the electric motor manufacturers of the country.

The committee on crane motors will present an outline specification designed to bring about a better standardization of electric crane motors with a view toward interchangeability of parts, thereby making it possible, by carrying a small number of spare parts, to make quick replacement in case of any crane motor failure.

The committee on train lighting equipment and practices has outlined a series of recommendations on the various subjects pertaining to the operation of train lighting equipment.

In addition to the committee reports, papers will be presented on "Method of Cost Keeping for Railroad Shop Power," by E. Wanamaker, electrical engineer of the Rock Island, and on "Maintenance of Lead Storage Batteries in Car Lighting Service," by Ernest Lunn.

THE HEADLIGHT ORDER

The following order has been issued by the Interstate Commerce Commission in relation to rules 29 and 31 for the inspection and testing of steam locomotives and tenders in accordance with Act of February 17, 1911, amended March 4, 1915.

It is ordered, That the rules and instructions prescribed by the Commission's order of October 11, 1915, be, and the same are hereby, amended by the addition of the following rules:

29. *Locomotives used in road service.*—Each locomotive used in road service between sunset and sunrise shall have a headlight which will enable persons with normal vision in the cab of the locomotive, under normal weather conditions, to see a dark object the size of a man for a distance of 1,000 feet or more ahead of the locomotive; and such headlights must be maintained in good condition.

Locomotives used in road service, which are regularly required to run backward for any portion of their trip, except to pick up a detached portion of their train, or in making terminal movements, shall have on the rear a headlight which will meet the foregoing requirements.

Nothing in the foregoing rules shall prevent the use of a device whereby the light may be diminished in yards and at stations to an extent that will enable the person or persons operating the locomotive to see a dark object the size of a man for a distance of 300 feet or more ahead of the locomotive under the same conditions as set forth above.

When two or more locomotives are used in the same train, the leading locomotive only, will be required to display a headlight.

31. *Locomotives used in yard service.*—Each locomotive used in yard service between sunset and sunrise shall have two headlights, one located on the front of the locomotive and one on the rear, each of which will enable persons with normal vision, in the cab of the locomotive, under normal weather conditions, to see a dark object the size of a man for a distance of 300 feet or more; and such headlights must be maintained in good condition.

It is further ordered, That said rules, 29 and 31, be, and they are hereby, made applicable to all new steam locomotives put in service subsequent to October 1, 1916, and to all steam locomotives given general overhauling subsequent to October 1, 1916, and that all steam locomotives subject to the rules be equipped in conformity therewith not later than January 1, 1920.

Master Car Builders' Association Proceedings

Report of the Thursday Morning Session, and Afternoon Meeting on Revision of the Rules of Interchange

President MacBain called the Thursday morning meeting to order at 9:30. The appointment of the Obituary Committee was announced. The association then considered the report of the Committee on Car Wheels.

Report of Committee on Car Wheels

This is one of the oldest of the standing committees; its work of developing and perfecting the standard wheels, as service requirements became more and more severe and as the state of the art progressed, has been invaluable. Necessarily it has had to have close co-operation from wheel manufacturers, and it has also found it necessary to keep in intimate touch with committees from other railway organizations. In the past year it has conferred with the subcommittee on track of the American Railway Engineering Association.

W. C. A. Henry, the chairman of the committee, has been associated with it for a number of years and succeeded Wm. Garstang, formerly of the Big Four, who headed the committee for many years. Mr. Henry is superintendent motive power of the Southwest System of the Pennsylvania Lines. He entered the service of the Pennsylvania as a special machinist apprentice at Altoona in 1891 and has served in various positions on that system and its western lines, being promoted to his present position in 1906. The other members of the committee are A. E. Manchester, superintendent motive power, Chicago, Milwaukee & St. Paul; J. A. Pilcher, mechanical engineer, Norfolk & Western; O. C. Cromwell, mechanical engineer, Baltimore & Ohio; J. M. Shackford, chief draftsman, Delaware Lackawanna & Western; H. E. Smith, engineer tests, New York Cent., and L. Brown.

W. C. A. Henry, Chairman

THE following resolution of the Committee on Maintenance of the American Railway Association was forwarded under date of November 7, 1913, by the general secretary of that association to the secretary of the Master Car Builders' Association:

"*Resolved*, That the subject of the contour of chilled car wheels and the throat clearance for frogs, guard rails and crossings be referred to the American Railway Engineering Association and the Master Car Builders' Association jointly for a full investigation and report, with their recommendations for any change that they may conclude is desirable."

This subject, having been referred to the Committee on Car Wheels, has been investigated jointly with the Committee on Track of the American Railway Engineering Association. It was originally brought up by the Association of Manufacturers of Chilled Car Wheels, that association arguing that the strength of the flange of the chilled iron car wheel has not kept pace with the increase in the load, and that the wheels under cars, especially of the higher capacities, should have the flanges thickened.

May 1, 1914, a Circular of Inquiry was sent to all members of the M. C. B. Association, requesting that special reports be made of all broken wheels, and explaining in detail the infora-tion desired. Replies were received from 33 railroads and 1 private car line, representing an owenship of 1,297,909 cars, approximately 46.2 per cent of the cars owned or controlled by railroads or individual companies, members of the M. C. B. Association.

Table I is a tabulation of replies received to this circular, covering all M. C. B. wheels of the present Standard cast from 1909 to 1915, having broken flanges and for which the flange thickness was given.

Fig. 1 shows the location and direction of the fracture for such of the wheels shown in Table I for which this information was furnished. Of the 103 cases shown in Table I, 62 were reported as the result of seams, 3 due to worn flange, 2 to

defective castings, 1 to worn tread, 1 over heated, 3 thick chill, no reason whatever being given for the remaining 31 cases. It will be seen that these failures are not by any means confined to wheels having the thinner flanges. The location and direction of the fracture in nearly all cases more nearly approaches the vertical than the horizontal, and does not occur through the minimum section of metal.

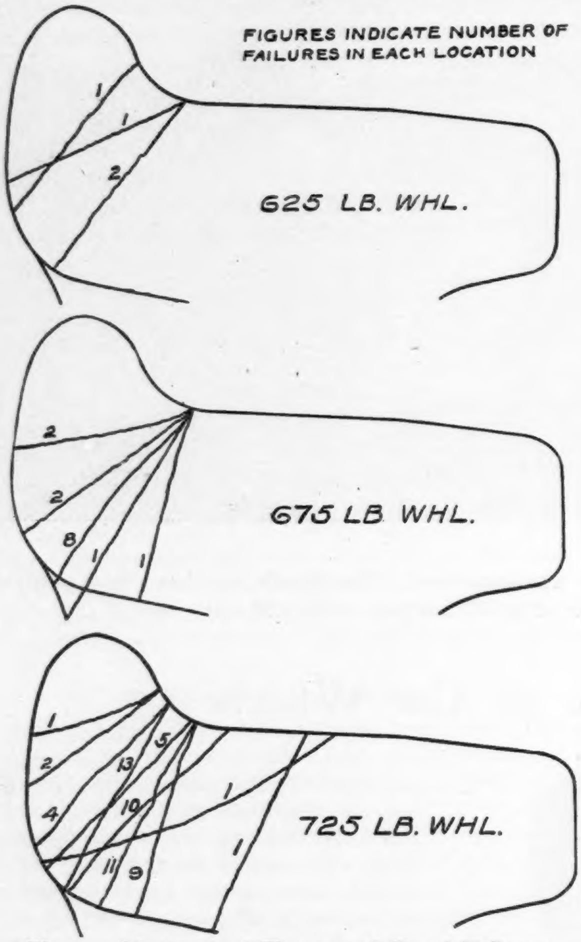


Fig. 1.—Summary of Flange and Tread Failures, Location of Failures

One of the roads represented on this committee has obtained the exact contour and dimensions of the flanges of all cast-iron wheels that were withdrawn from service on account of seams in the tread at or near the throat of the flange during a period of twelve months. Some of the lighter of these are accurately shown in Fig. 2; also the outline of the flange and a portion of the tread of the M. C. B. Standard cast-iron wheel are shown. In obtaining these specimens in each case the flange back of the seam was broken off with a sledge, and the outline traced from a section cut at the middle of the seam. The depth of the seam is indicated by the heavy line extending downward from the tread. All of these cases, if not detected by inspection and the wheel withdrawn from service, would have finally resulted in a so-called broken flange, and for purposes of study are of the same value as if actually broken off in service.

Of the twelve cases shown in Fig. 2 it will be noted that there are no fractures in even an approximately horizontal direction across the flange, while in a number of cases the fracture extends in an almost perpendicular direction, and is distinctly a tread failure. Particular attention is called to flange No. 2, which failed on account of a steam starting about midway between the top of the flange and the base line. It would be expected in this case that if the flange proper were not sufficiently strong for the purpose intended and the service to which subjected, it would have broken off in a nearly horizontal direction.

It is most apparent from a study of the thickness of the flanges as shown in Table I, the location and direction of the fractures as shown in Figs. 1 and 2, that the flange thickness at or near the base line, or for such distance from the base line as would affect rail clearances, can have little or no bearing on failures of this nature, as in the majority of cases the original failure occurs in the tread, and the term "Broken Flange" as ordinarily used is being applied to what is primarily a tread failure.

A flange thicker than the present Standard has some distinct disadvantages. One of the strongest arguments offered for the adoption of the present taper of tread of 1 in. in 20 in. was the opportunity afforded a pair of wheels to move laterally until both run upon a common diameter, this condition tending to keep flanges away from the rail, thereby not only decreasing the flange and rail wear, but train resistance as well. Unless the whole track structure is changed, a thicker flange would

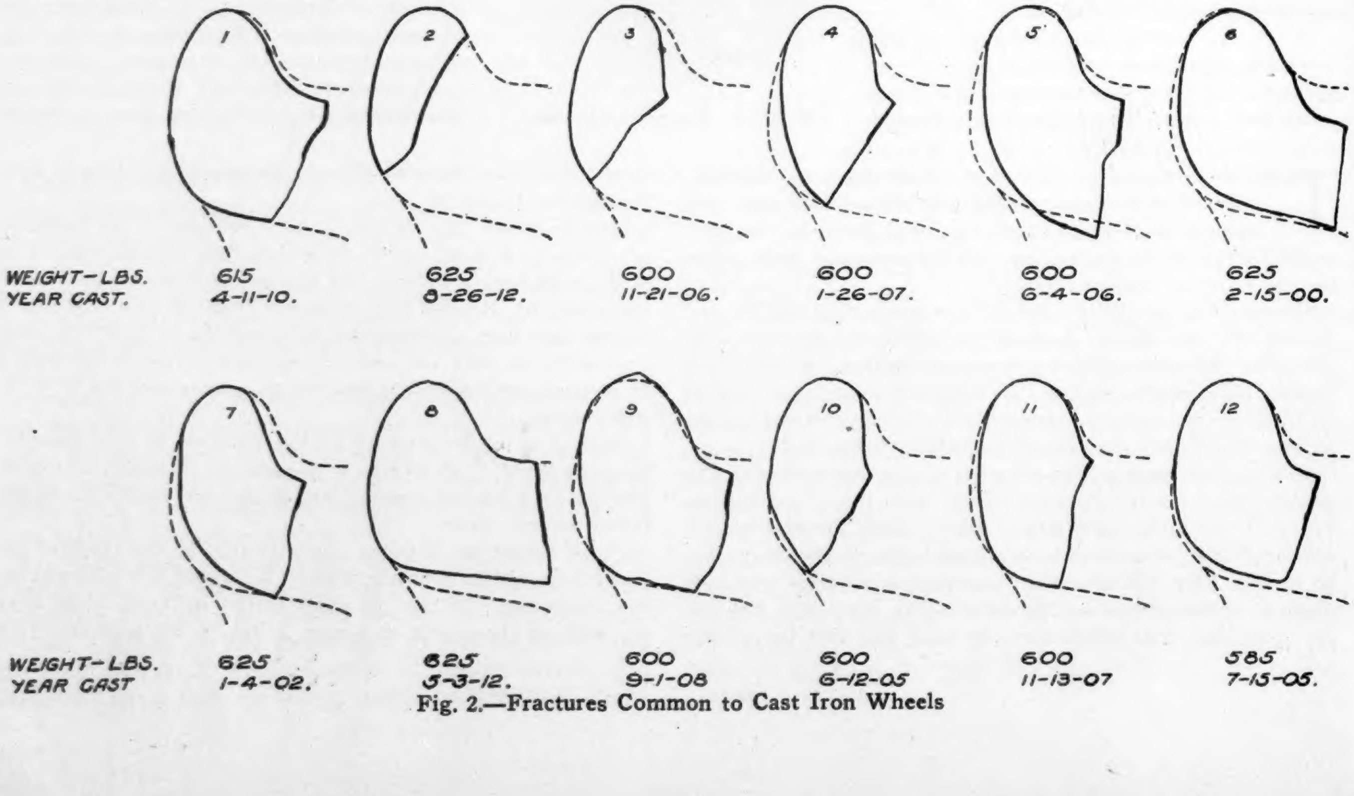


Fig. 2.—Fractures Common to Cast Iron Wheels

reduce or eliminate entirely this opportunity for lateral motion.

One railroad made a trial, under tenders, of special cast-iron wheels having a flange of ⅛ in. greater thickness than the present M. C. B. Standard. These wheels were mounted 4 ft. 8 in. throat to throat, or 5/16 in. wider than Standard. The average age of 203 of these wheels when condemned was 11 months. Of a like number of M. C. B. wheels in the same service, the average age when condemned was 11.1 months.

WT. OF WHL LBS	YEAR CAST	NUMBER BROKEN FLANGES REPORTED THICKNESS OF FLANGE AT A POINT 3/8" ABOVE TREAD							TOTALS.
		LESS THAN 15/16"	15/16" TO 1"	OVER 1" TO 1 1/16"	OVER 1 1/16" TO 1 1/8"	OVER 1 1/8" TO 1 3/16"	OVER 1 3/16" TO 1 1/4"	OVER 1 1/4"	
625	1915								
	1914	1							1
	1913							1	1
	1912	1			2		2		5
	1911							1	1
	1910				1			1	2
	1909		1						1
	TOTAL	2	1		3		2	3	11
675	1915								
	1914						1		1
	1913		2	1	1		2		6
	1912			1	1	2	2		6
	1911			1					1
	1910		2						2
	1909			3					3
	TOTAL		4	6	2	2	5		19
725	1915								
	1914			2	1	2		2	7
	1913		2	2	5	6	2	2	19
	1912		1	11	5	3	5		25
	1911		1	4		1	2		8
	1910			6	1	3	2	2	14
	1909								
	TOTAL		4	25	12	15	11	6	73

Table 1.—Summary of Flange and Tread Failures

Of the special wheels, 28 per cent were condemned on account of worn flange, the average age of which was 12.5 months. Of the M. C. B. wheels, but 15.2 per cent were condemned on account of worn flanges, the average age in this instance being 13.7 months. These figures indicate that the thicker flange did not improve conditions, but rather the reverse. Two roads report having experimented with thicker flanges, and upon examination found that the back of the flange in almost every case was grooved by contact with guard rails and frogs. Four typical cases are shown in Fig. 3.

Under date of March 14, 1916, the committee addressed a communication to the Subcommittee on Track of the American Railway Engineering Association, advising that it was the unanimous opinion of this committee after a thorough study of flange failures and so-called flange failures, that the addition of metal to the back of the flange within any limits that would alter the relation of the flange to the track would have no effect whatever on flange failures; furthermore, that we see no reason for recommending any changes for throat clearances for frogs, guard rails and crossings, and that it was the recommendation of this committee that there be no change in the dimensions and contour of flanges of car wheels or throat clearances for frogs, guard rails and crossings, as adopted in 1909.

The committee is unanimously of the opinion that nothing will be gained in the interests of safety or economy by adding metal to any portion of the flange of cast-iron car wheels in such location as will in any way affect track clearances.

It has been recommended that this Association should have standard maximum and minimum pressures for mounting wrought-steel and cast-iron wheels on axles of the different sizes, and the following table is hereby submitted for consideration, with the recommendation that it be adopted as Recommended Practice:

MOUNTING PRESSURES IN TONS

Axle.	Wheel-Seat Diameter.	Cast-Iron Wheels. Minimum.	Cast-Iron Wheels. Maximum.	Steel Wheels. Minimum.	Steel Wheels. Maximum.
A	5⅛ in.	30	45	45	60
B	5¾ in.	35	50	50	70
C	6½ in.	40	60	60	80
D	7 in.	45	65	65	85
E	7⅝ in.	50	70	70	95

There appears to be more or less misunderstanding as to the condemning limits for steel-tired wheels as shown on M. C. B. Sheet C. In order to make the matter more clear, we would recommend that the illustrations referring to this be changed, the change consisting in removing reference to the flange height, which has no bearing on this subject, and indicate that certain other dimensions affected by wear are all minimum dimensions.

The committee has received a complaint that it is extremely

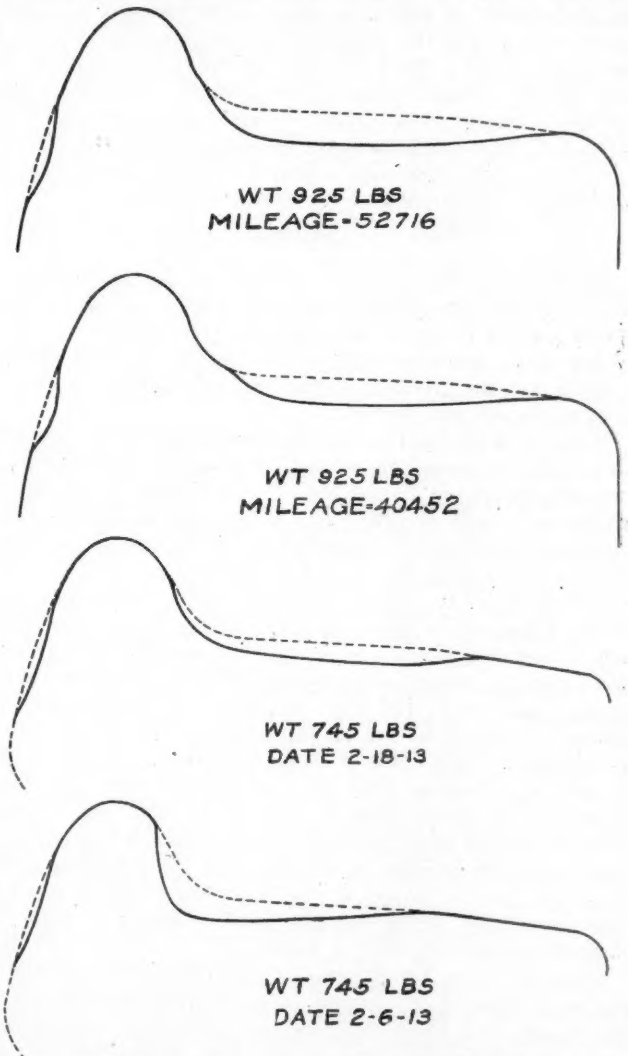


Fig. 3.—Wear of Wheels Having the Thick Flanges

difficult to maintain tools for turning the limit of wear groove for steel and steel-tired wheels, and it has been recommended that to correct this trouble the shape of the limit of wear groove be slightly modified so that there will be a fillet at the bottom of the groove instead of the present sharp angle. It is therefore recommended that the shape of the limit of wear groove be so changed.

In presenting the report Mr. Henry said: I wish to say there is one error in Fig. 3. The word "minimum" follows the dimension ¼ in., which is the distance between the measuring line and the condemning limits. The word "minimum" should not appear.

Since the report was sent in there has been a joint meeting of our committee with the Train Brake and Air Signal Committee in reference to the failure of wheels under refrigerator cars, and the committee would like to have the following considered as a supplement to its report:

In our report to the 1915 Convention reference was made to the large number of cast iron wheels under refrigerator cars having cracked and broken plates, and calling attention to the high braking power of these cars, considering the weight of wheel used. A recommendation was made that this matter be investigated jointly by the Car Wheel and the Train Brake and Air Signal Committees. This investigation has been made, and it is agreed that no change should be made in the braking power of refrigerator cars, but to reduce wheel failures under this as well as other classes of equipment it will be necessary to change our standards, so that in addition to prescribing the maximum gross load for each weight of cast iron wheel, there will also be a limitation placed upon the braking power permissible. The braking power being a fixed per cent of the light weight of the car, this additional limitation can probably best be handled by specifying for each weight of wheel the maximum light weight of car in addition to the maximum gross load. Necessary information should be available to permit specific recommendations being made at the next Convention.

DISCUSSION

Mr. Henry: Mr. Lyndon, president of the Association of Manufacturers of Chilled Iron Car Wheels, is present and would like to be given an opportunity to explain the view of the wheel manufacturers on the subject of wheel design. I move that the privilege of the floor be extended to him.

(The motion was carried.)

G. W. Yyndon: It is a distinguished honor to be permitted to address you upon this subject. I speak for 24 manufacturers throughout the United States, representing a capacity of 20,000 car wheels per day. Our association has been making representations for the improvement of the flange ever since the introduction of the 40- and 50-ton capacity cars.

The flange of the 30-ton cars is in every respect the same as the flange of the 50-ton cars, and as the Master Car Builders' Wheel Committee has notified our association that they were ready to recommend a chilled iron car wheel for 70-ton cars, it must carry the same flange as the 30-ton cars, providing the report of the standing committee on car wheels is accepted. The limit of flange resistance due to lateral stresses and impacts must be reached some time, and loads cannot be increased from 30 tons to 70 tons and upwards without making some provision for increased flange strength. Your attention is called to the fact that the thickness of the flange of the car wheel is the only dimension in car and track structures which has not been increased to meet the demands of modern railway service.

Since the year 1904 the chilled iron car wheel manufacturers have asked your association to increase the strength of the flange, and every time we have been told that nothing could be added to the back of the flange because of the limitations of flangeways in track. On page 141 of your proceedings for the year 1912 you recommended that our association refer this question to the American Railway Association. Supplementing the above recommendation a communication was received from the chairman of the Master Car Builders' Wheel Committee as follows: We can see no objection to your suggestion to having the American Railway Engineering Association appoint a committee to consider this subject in connection with the Association of Manufacturers of Chilled Car Wheels and the Master Car Builders' Association Committee. '

This placed the whole subject before the American Railway Association. From the year 1912 to March 23, 1916, our association labored continuously with the American Railway Association, the American Railway Engineering Association and the Manganese Track Society and various frog and crossing manufacturers with the sole and only object of establishing track limitations to wheel flange design. At the 1916 convention the Track Committee of the American Railway Engineering Association was ready to make its official report to the effect that the flange of car wheels could be thickened 3/16 in., as desired, without any interference in frogs or crossings.

After having opened the way for the improvement of the flange, and after having established through the American Railway Engineering Association track limitations to wheel flange design, we respectfully submit that further investigation and study should follow. Our association is carrying on tests with reference to design and increases in plate thicknesses in our own foundries. We have enlisted the cooperation of the Bureau of Standards, at Washington, and the University of Illinois. These tests, in conjunction with the tests now being conducted at the Altoona shops of the Pennsylvania Railroad, should enable us to establish fundamentals as to the factor of safety in all parts of the wheel. Therefore, we request a postponement of definite action and the continuance of further study of this subject.

W. E. Dunham (C. & N. W.): The situation at the present time indicates that the standard design of wheel needs revision and that, particularly, to take care of the brake loads. The investigation of the maximum brake load which each type of wheel can stand should be investigated.

D. R. McBain (N. Y. Cent.): I think that the design of the wheel as a whole is of vastly greater importance than any consideration of the increased flange at the present time, although it may be possible that the flange will need attention as well as the rest of the wheel.

T. H. Goodnow (C. & N. W.): While there is some mention made of it in this report, in recent investigations which we have had occasion to make we find that the majority of the wheel failures today come from cracked plates. While that particular feature has been confined in the report to refrigerator cars and heavier cars, the trouble is not confined to that class of equipment. We are having that trouble on the very lightest type of equipment, the stock cars. It occurs in cars which are run in prairie country.

We have found that the failures, particularly on cracked plates, which was the defect we were following up, were very much more on foreign roads, particularly on roads with long, heavy grades, so that it is very evident that the failures of cast iron wheels to-day are not confined to the flanges.

F. H. Clark (B. & O.): I would like to ask whether the trouble from cracked plates is mostly on wheels recently made or whether it occurs on older wheels.

Mr. Goodnow: Whether it is a recent development or not I cannot say, but it is not confined to the lightweight wheels. The 80,000-lb. capacity wheel is the principal offender.

F. F. Gaines (C. of Ga.): Most of our failures are not flange failures, they are tread failures, and that is more or less due to the brake shoe pressure on long grades, the treads splitting sometimes from 6 to 18 in.

D. F. Crawford (Penna. Lines): The American Railway Association has asked the Master Car Builders' Association and the American Railway Engineering Association to give it the benefit of their opinion as to what should be done with reference to the thickness of wheel flanges and, therefore, this report has been very largely confined to that investigation. It was not the intention of the committee, as I understand it, to indicate that the flange was the only important part of the wheel, but really to show how unimportant it is.

It is most unfortunate, no matter what the merits of the case, that wheels have been manufactured with thicker flanges than the railways have arranged to provide for operating. It is shown that the back of these flanges are hitting the guard rails and frog points; otherwise, the wheels would not

be worn. Track maintenance costs as much as wheel maintenance, and it is important that the thing that has to run on the track should fit the track.

I believe that the wheels manufactured and used in this country, until the American Railway Association or some other association shows what can be done with both the wheel and the track, should be confined to a thickness of flange that will operate properly through the throat ways of frog and guard rails.

O. D. Buzzell, (A. T. & S. F.): We operate a great many refrigerator cars over heavy mountain grades. We have had comparatively little trouble with flange failures, but we do have considerable trouble with cracked plates, but possibly not as much trouble with cracked plates as with the shelled out treads from brake burns. I believe that we have got to take into consideration the light weight of the cars in making our wheels suitable for that class of equipment. Our cracked plates and shelled spots or brake burns. During the recent our brake burns are very much worse.

C. E. Chambers (C. R. R. of N. J.): I am thoroughly in accord with what Mr. Crawford said about the flanges of wheels. If you will look at the committee's report, you will see exactly what the effect has been on wheels built up with other than M. C. B. flanges.

R. P. Blake (North Pacific): I wish to endorse the remarks just made regarding wheel failures on account of cracked plates and shelled spots or brake burns. During the recent busy season we have had occasion to handle a great deal of foreign equipment. We had to change a great many of the wheels, and much of the trouble was due to shelled spots. The cracked plates would develop after the cars had passed over the line and returned, but many of these shell spots were in evidence when the cars started over the road. It was noticeable that a large percentage of these cars were not in line on the two pairs of wheels. I have seen many cases in which these shelled spots were developed where the rib on the inside of the plate was attached to the flange of the wheel.

Mr. Henry: There seems to be a tendency in discussing this report to combine practically every other part of the wheel with the tread. We had specific instructions to report on the flange. In our report to the convention last year we had something to say about plate failures. As a result of our investigations the Pennsylvania is making the tests at Altoona that are referred to in our report. It is hoped that we can bring definite recommendations to the association next year on the question of the shape of the plate and the thickness of the plate. We also hope to have recommendations covering the maximum allowable braking power for the different weights of wheels.

There were reported to us 42 broken flanges on wheels having a weight of 750 lb., which is a considerably heavier wheels than we are now using. While we are not in position to say whether the flange on these wheels is thicker than the standard or not, I feel safe in saying from what information I have on the subject of heavy wheels that these flanges were heavier than the standard. In 1907 the thickness of the flange was increased. There was metal added to the back that brought the thickness of the flange up to 1⅛ in. While we have thickened the flange the condemning limit now is just the same as it was then; in other words, we start the flange out thicker but let it run to just as thin a point as when we had a thinner flange, so that in the end we have not gained anything.

I would like to read a letter from Mr. J. B. Jenkins, chairman of the Track Committee of the American Railway Engineering Association, bearing on this subject. Mr. Jenkins says: "In the matter of the proposed increased thickness of wheel flanges and increased flangeways which the Track Committee was instructed to take up with your Committee of the Master Car Builders' Association, I would advise that a sub-committee of the Track Committee reported in favor of permitting the thickening of the flange of the chilled car wheels for 140,000 lb. capacity cars as requested by the Association of Manufacturers of Chilled Car Wheels and that a standard gauge of track of 4 ft. 8¼ in. be adopted for use through all frogs and crossings. This recommendation, I understand, was made with the understanding that the distance between the backs of the wheel at a distance ¼ in. below the top of rail would not be decreased by the change of design and that the thickening of the flange of the car wheel would therefore not require any increase in the flangeway.

"The report of the sub-committee, however, was not adopted, but was referred back for further consideration with a request to submit a report. . . . . In place of submitting another report, however, the chairman of the subcommittee wrote that inasmuch as the necessity for recommendation or action on matters pertaining to track are dependent entirely upon the thickening of the wheel flange becoming a fact, and since this is not likely to come about, in face of recommendation of the M. C. B. Association, further consideration of the subject by the A. R. E. A. is not necessary. . . . . In view of the matter having been referred back to the sub-committee, the committee has recommended in its report the continuation of this subject for next year's work, and in view of the ascertainment by the committee that the Board of Direction have again given this subject to the Track Committee the committee did not alter its recommendation for the continuance of the subject. I might say, unofficially, that no change in the flange of wheels which requires an increased flangeway will be favorably considered by the Track Committee."

R. E. Smith, (A. C. L.): I think I am correct in stating that the purpose of the association in maintaining a standing committee on car wheels is to give the association accurate and reliable information on the general subject of car wheels. I would like to suggest therefore that there be included in the committee's next year's work information as to the comparative safety of chilled wheels and steel wheels, and also the comparative economy in the use of chilled wheels and steel wheels, this latter subject bringing out the mileage of steel wheels between turnings and any other relating subject. I would like to submit it as a motion.

(The motion was seconded.)

D. F. Crawford, (Penna. Lines): As I understand the Wheel Committee is a standing committee of this association. Its scope covers the entire question of wheels, steel and cast iron, and it seems to me it is a mistake to burden the committee with specific instructions as to what it is to report on next year. Let the executive committee decide what it wants them to bring in next year's report.

F. W. Brazier, (N. Y. Cent.): I would like to amend Mr. Smith's motion that the subject be referred to the incoming executive committee, to have a special committee appointed The Wheel Committee is overburdend now with its work.

(Mr. Brazier's amendment was incorporated in the motion.)

O. C. Cromwell, (B. & O.): The question of the increased thickness of flange the committee considers a minor one. We did not mean to convey by the report that we had discarded any further consideration of flanges, but it is the flange with the rest of the wheel. The whole wheel must be brought into balance; it is out of balance now. We know from the study of the wheel that if you take a known design and make that one design in different foundries, a certain foundry manufacturing that particular wheel will have a certain class of failures in that wheel, and another foundry will have another class of failures in the same wheel. It is not all a question of the design; it is a question of foundry practice and equipment. There is more than one feature of the wheel as manufactured that we want to take into consideration. The people who are having trouble with cracked plates, if they will flood that information in to the

committee in such shape that we can analyze it, give us the dates, and name of the manufacturer (we will not make that part public) it will aid the committee in arriving at some conclusion as to the cause of the trouble. I don't know whether the association appreciates the cast iron wheel situation. It is proposed to move the flange closer to the rail by 3-32 in. on each side, cutting down the lateral play of the wheel on each rail. That is going to mean increased flange wear and less mileage. The committee has taken all these points into consideration in reporting on the question of the increase of the flange, and, from the information in hand, could not report otherwise. While we know we can make a flange stronger by making it heavier, do we need it heavier? We know also that in running through yards, and frogs where the tracks have recently been closed in, that you will have more trouble with broken flanges on new wheels, than on the old, worn ones.

If you will examine carefully some of the details of this report, you will find that there are just as many if not more, flanges reported broken where they were full than where they were thin. This signifies that something else besides the thickness had to do with it. Mr. Henry made very clear that they were not properly named flange breakages, but they are merely breakages of the rim or tread. They do not break off in spots just where they are struck, but they form seams and break well around the wheel, showing that it is a question of progressive cracks that are influenced, otherwise than by the shock that is brought on the particular point of the flange at the time. I simply want to bring out this point, because we are prone in our examination of every defect to make the most of that one which gives us the most trouble for the time being. It is therefore necessary that every one interested in the wheel should keep exact data, so that when information is to be gathered for a general discussion or general conclusions, there will be ample material at hand to draw real conclusions from.

Mr. Henry: The wheel manufacturers tell us that the limit of strength of the flange of the 625-lb. wheel is 90,000 lb., and that the limit of strength of the flange of the 675-lb. wheel and the 725-lb. wheel is 110,000 lb., or 20,000 lb. more.

The dimensions of these flanges are identical; there is this difference, however, that what is spoken of as the throat thickness, that is, the thickness through the tread, is greater with the heavier wheel, and that would seem to indicate very clearly that thickening the tread of rim of the wheel will increase the strength of the flange, but this in no way affects the flange coming in contact with the track.

(Mr. Smith's motion was carried.)

O. C. Cromwell: We find that even the M. C. B. standard wheel is not exactly adhered to by all the foundries. The plates will vary from the dimensions shown on the M. C. B. drawings, between the different manufacturers. One weight of wheel varies a little more in that particular than others, and we feel that that wheel is very much out of balance. We find that gives more trouble than the other two.

(On motion, the proposed table for mounting pressures for wheels was referred to letter ballot.)

Report of the Committee on Couplers

A great deal of very hard work has been done in the past few years by the Coupler Committee toward the development of the standard M. C. B. coupler. The manufacturers have co-operated very willingly with the committee and have responded promptly to all requests made in connection with the committee's work; and the committee has greatly appreciated this co-operation. Much of the burden of the development of this coupler has fallen on the Pennsylvania Railroad and the mechanical department of this road deserves special credit.

The members of the committee have always responded promptly to the calls of the chairman and have either been present in person or have had representatives at all of the committee meetings. While all the members of the committee deserve a great deal of credit for the work accomplished, special credit is due the chairman, R. L. Kleine, chief car inspector, Pennsylvania Railroad. The other members of the committee are: G. W. Wildin, mechanical superintendent, New York, New Haven & Hartford; F. W. Brazier, superintendent of rolling stock, New York Central; F. H. Stark, superintendent of rolling stock, Montour Railroad; J. W. Small, superintendent of motive power, Seaboard Air Line, J. A. Pilcher, mechanical engineer, Norfolk & Western, and A. E. Manchester, superintendent of motive power, C. M. & St. P.

R. L. Kleine, Chairman

At the 1911 convention the committee was instructed to design a standard M. C. B. coupler. The general condition and difficulties existing with couplers in general service at that time were investigated on many of the railroads throughout the United States. This resulted in formulating a set of specifications on design, operation and strength which would be desirable in the standard coupler. The coupler manufacturers were then invited to jointly take up this work with the committee. The specifications were jointly revised and each manufacturer submitted one to two couplers, total nine, conforming to these specifications, but embodying working parts designed according to their ideas to meet the specifications. These couplers were tested and two were selected to be tried out in actual service, and were known as Type *A* and Type *B* Experimental Standard M. C. B. Couplers. As a result of road, physical and service machine tests, changes were made in both these couplers. Couplers embodying these changes were designated Type *C* (superseding Type *A*) and Type *D* (superseding Type *B*) and are shown in Figs. 1 and 2.

After finally settling upon the details in the Types *C* and *D* couplers, the members were requested to place a number of each of these couplers in service, and the committee proceeded with the various physical, shop and road tests, with a view of selecting and recommending one standard coupler to the Association.

Dynamic and Static Tests

These comprise the Strike (Sb), Guard Arm (Gb), Jerk (Jb), Pulling (Pb) and Static Guard Arm (Hb) tests. They were conducted and recorded in the same manner as previous tests, which were described in the 1915 Proceedings, page 253.

Briefly summarized as a total comparison, it may be stated that these tests show that the highest development of strength has been obtained in the Types *C* and *D* couplers when compared any of its predecessors or the "Present" types of couplers.

A summary of these tests is shown in the accompanying tables.

The pounds ultimate pull per pound of weight compares as follows:

"Present" couplers	896
Type *C* couplers	1183
Type *D* couplers	1186

and the strength of the *C* and *D* couplers is 100 per cent increase over the "Present" types of couplers, with an increase of approximately 33 per cent in weight. This increase in weight is absolutely essential to produce a coupler in which the stresses will be within the elastic limit of the material. The road tests of couplers with this increase of strength on locomotive tenders show a minimum increased life of 300 per cent over "Present" types of couplers, and similar advantages will obtain on freight car equipment.

WEIGHT OF TYPES *C* AND *D* COUPLERS

The weights of the 40 couplers subjected to the physical tests varied, depending upon the size of shank, whether solid or slotted, also whether 9 in. or 11 in. knuckle face. Some roads use couplers with 11-in. knuckle face on locomotives. The minimum weight was 390.5 lb. and the maximum 430 lb.; average weight of Type *C*, 410.05, and of Type *D* 409.05 lb. There will be no difficulty in setting 400 lb. for the average of couplers, to conform to action of convention last year, with a tolerance above and below the prescribed limit.

ROAD TESTS

The road tests on "Present" (couplers in general use), "Experimental" (preceding Types *A* and *B*) and Experimental Standard Types *A* and *B* (applied 1914) couplers were continued during the past year, and a number of Experimental Standard Types *C* and *D* (which superseded Types *A* and *B*,

SUMMARY—COUPLER SHANK AND KNUCKLE PIN DEFLECTION AND KNUCKLE CLOSURE. DYNAMIC STRIKE (Sb) TESTS.

TYPES C AND D EXPERIMENTAL STANDARD M. C. B. COUPLERS.

Coupler and Contour.	Size of Shank. (Inches.)	After M. C. B. Test—3 Blows at 5 Ft. and 3 at 10 Ft. Shank Defl (Limit 1⅞ In. 5 by 7.) Top.	Bottom.	Knuckle Pin Defl.	Permanent Set C	C′	Final. Add. Blows at 10 Ft.	Shank Defl. Top.	Bottom.	Knuckle Pin Defl.	Permanent Set. C	C′	At Add. 10 Ft. Blow.	Test Discontinued on Account of
C-5	5 by 7	.75	.281	.062	.2	.060	19	2.00	1.75	.187	.715	.490	15	Cracks at 5 different locations.
C-10	5 by 7	.625	.562	.062	.225	.190	15	2.125	2.00	.187	.9	.765	15	Knuckle closure exceeded limit. Crack .031 by 1.75 in. at bottom lug.
C-10	5 by 7	.437	.375	.093	.125	.140	7	.75	.625	.156	.3	.360	7	Knuckle not operative. Crack .031 by 2 in. back of bottom lug.
C-10	6 by 8	.75	.5	.125	.255	.190	15	1.437	1.312	.187	.765	.725	15	Crack .062 by 1.25 in. at the bottom lug Knuckle not operative.
Average.........		.6405	.4295	.0855	.20125	.145	14	1.578	1.42175	.17925	.67	.5875	13	See plot sheets for further notes.
D-5	5 by 7	.625	.25	.062	.110	.045	26	2.437	2.25	.468	.615	.550	23	Cracks around shank, at top and bottom lugs and liner block. Broke through the back wall of head.
D-10	5 by 7	.5	.375	.062	.175	.125	17	2.00	2.00	.375	.7	.575	15	Broke through back wall of head.
D-5	6 by 8	.875	.781	.062	.070	.095	15	2.00	2.093	.375	.575	.690	15	Cracked at bottom lug and at bottom side of head. Knuckle not operative.
D-10	6 by 8	.5	.375	.062	.085	.080	15	2.00	1.437	.312	.520	.590	15	Knuckle not operative. Cracked at top lug and at bottom side of head.
Average.........		.625	.44525	.062	.110	.08625	18.25	2.10925	1.945	.3825	.6025	.60125	17.25	See plot sheets for further notes.

SUMMARY—COUPLER SHANK DEFLECTION AND SPREAD OF GUARD ARM. DYNAMIC GUARD ARM (Gb) TEST

TYPES C AND D EXPERIMENTAL STANDARD M. C. B. COUPLERS.

Coupler and Contour.	Size of Shank. (Inches.)	After M. C. B. Test—3 Blows at 3 Ft. and 4 at 5 Ft. Shank Defl. (Limit 1½ In. for 5 by 7.) Top.	Bottom.	Spread Guard (Limit 7/16 In. for 5 by 7.) A	A′	Final. Add. Blows at 5 Ft.	Shank Defl. Top.	Bottom.	Spread Guard Arm. A	A′	At Add. 5 Ft. Blow.	Test Discontinued on Account of
C-5	5 by 7	1.156	1.375	.035	.010	31	2.562	3.00	.235	.110	31	Tup striking face of guard arm.
C-10	5 by 7	.781	.875	.025	.020	43	2.562	3.00	.115	.125	43	Tup striking face of guard arm. Crack .031 by 1 on top side of shank, near junction to head.
C-5	6 by 8	.5	.437	.295	.055	95	1.875	2.062	1.1	.925	95	Tup striking face of guard arm. 4 cracks in guard arm ribs.
C-10	5 by 7	1	1.156	.035	.025	59	3.062	3.031	.835	.555	59	Tup striking face of guard arm. 4 cracks in guard arm ribs.
Average...........		.859	.961	.097	.027	57	2.265	2.773	.571	.429	57	See plot sheets for further notes.
D-5	5 by 7	.812	1	.105	.015	65	....	....	.550	.3	63	Broke at shank 20 in. from butt.
D-10	5 by 7	.593	.875	.1	.030	40	....	....	.365	.115	39	Broke at shank 19.5 in. from butt end.
D-5	6 by 8	.812	.75	.185	.105	37	....	....	.510	.5	35	Broke through shank 18.5 in. from butt end. Also broke through top face.
D-10	6 by 8	.75	.5	.115	.1	139	2.312	2.562	.765	.830	139	Tup striking face of guard arm.
Average...........		.741	.781	.126	.062	70.25	2.312	2.562	.547	.436	69	See plot sheets for further notes.

respectively) were added to the tests. The tests were conducted along the same lines as in previous years. These tests show very conclusively the very short life that is obtained from the "Present Type" couplers as compared with the "Experimental Types" and "Types *A* and *B* Experimental Standard" couplers. From the results thus far obtained on the Types *C* and *D* Experimental Standard M. C. B. Couplers, it is safe to draw the conclusion that their life will exceed the service results of any type previously developed.

SUMMARY—COUPLER SHANK AND KNUCKLE PIN DEFLECTION AND KNUCKLE OPENING. DYNAMIC JERK (Jb) TEST.

TYPES C AND D EXPERIMENTAL STANDARD M. C. B. COUPLERS.

Coupler and Contour.	Size of Shank. (Inches.)	After M. C. B. Test—3 Blows at 5 Ft. and 3 Blows at 10 Ft.					Final.							Test Discontinued on Account of
		Shank Defl. (Not specified.)		Knuckle Pin Defl.	Permanent Set.		Add. Blows at 10 Ft.	Shank Defl.		Knuckle Pin Defl.	Permanent Set			
		Top.	Bottom.		C	C′		Top.	Bottom.		C	C′	At Add. 10 Ft. Blow.	
C-5	5 by 7	0	0	.062	.110	.095	83	.062	.375	.375	.755	.480	83	Broken through top side of shank at liner block.
C-10	5 by 7	0	0	.062	.140	.150	41	0	0	.218	.395	.310	39	Knuckle broken through pivot pin hole.
C-5	6 by 8	0	0	.062	.2	.230	33	0	0	.406	.770	.750	33	Knuckle opening exceeding the limit. Crack .015 by 2.25 in. front of liner block.
C-10	6 by 8	0	0	.125	.185	.140	53	0	0	.406	.755	.575	51	Knuckle broken through pivot pin hole.
Average.........		0	0	.07775	.15875	.15375	52.5	.0155	.09375	.35125	.66875	.52875	51.5	See plot sheets for further notes.
D-5	5 by 7	0	0	.031	.110	.110	31	0	0	.062	.4	.350	27	Broken through bottom lug.
D-10	5 by 7	0	0	.031	.165	.115	130	0	0	.156	.705	.585	127	Broken through top face of contour at center line.
D-5	6 by 8	0	0	.031	.210	.175	54	....	....	.187	.605	.6	54	Broken through shank at liner block.
D-10	6 by 8	0	0	.031	.220	.165	56	0	0	.25	.775	.735	56	Knuckle opening exceeding the limit.
Average.........		0	0	.031	.17625	.14125	67.75	0	0	.16375	.62125	.5675	66	See plot sheets for further notes.

The tests on the wedge-lock type of coupler have proven that the original gage can be practically maintained until the lock seats on the bar; but in pulling, the lock works up to the anti-creep position, and this tendency is so great that it breaks the anti-creep lug on the lifter. When the wedge lock works up, the gage of the coupler is increased, which makes it undesirable.

SUMMARY—KNUCKLE PIN DEFLECTION. STATIC PULLING (Pb) TEST.

TYPES "C" AND "D" EXPERIMENTAL STANDARD M. C. B. COUPLERS.

Coupler and Contour.	Size of Shank. In.	Ultimate Load.		Location of Fracture.
		Lb.	Knuckle Pin Deflection. In.	
C-5	5 by 7	452 140	9/32	Coupler head, through both lifter holes.
C-10	5 by 7	476 580	1/8	Coupler shank broke off 9 in. from horn.
C-5	6 by 8	518 980	5/16	Coupler shank broke off at junction to liner block.
C-10	6 by 8	478 560	3/8	Coupler shank broke off at junction to liner block.
Average		481 565	17/64	See plot sheets for further notes.
D-5	5 by 7	526 300	1/16	Knuckle broke at junction of hub to tail.
D-10	5 by 7	511 140	1/32	Knuckle broke through pin hole.
D-5	6 by 8	474 820	1/32	Coupler shank broke off at junction to liner block.
D-10	6 by 8	445 400	1/32	Knuckle broke through inside of hub.
Average........................		489 415	1/32	See plot sheets for further notes.

	Type C	Type D
Average complete weight....................................	407	412
Average lb. pull per lb. of weight....................................	1183—	1186

NOTE.—All 5 in. by 7 in. shanks were M. C. B. slotted. All 6 in. by 8 in. shanks on Type C were solid, and on Type D were slotted. All butt ends were 9⅛ in. All knuckle faces were 9 in. except Type D of 6 in. by 8 in. shank which were 11 in.

It is too early to draw any conclusions from the operation of the Types *C* and *D* couplers in the road tests on account of the limited length of service. The ease of operation of any coupler properly designed depends upon the fitting of the parts, weight of the parts to be moved and the smoothness of the surfaces in contact. A coupler is not only a steel casting for strength, but must perform certain mechanical functions. When these couplers are turned out by the manufacturers they operate satisfactorily, but after being exposed to the weather rusting takes place and, together with infrequent operation, in many cases the couplers begin to work stiffly, especially the knuckle-throwing feature. Lubrication of the contact surfaces will again place the coupler parts in freely operating condition. Therefore, in order to obtain maximum operating efficiency, the contact surfaces of the moving parts should be lubricated with a heavy oil. Such lubrication will be effective from two to three months.

SERVICE-TESTING MACHINE

The Types *C* and *D* couplers, with both top and bottom operation, were tested on the service-testing machine at the works of the American Steel Foundries, at Alliance, Ohio, the

tests being conducted in the same manner as described in the 1914 Proceedings.

The Type *D* coupler passed this test satisfactorily, whereas the Type *C* coupler revealed a number of defects, requiring changes which are given under the Lock-creeping Tests.

LOCK-CREEPING TESTS

The machine used for making these tests imparts a vibration to the knuckles of the couplers, and hence a lifting or creeping tendency to the locking blocks. Two couplers are mounted in horizontal coupled position with tension applied

SUMMARY—KNUCKLE OPENING. STATIC PULLING (Pb) TEST.

Types C and D Experimental Standard M. C. B. Couplers.

Coupler and Contour.	Size of Shank. (Inches.)	Permanent Set, In.									
		At 150 000 Lb.		At 175 000 Lb.		At 200 000 Lb.		At 300 000 Lb.		At 400 000 Lb.	
		C	C′	C	C′	C	C′	C	C′	C	C′
C-5	5 by 7	.010	0	.042	0	.050	0	.163	.074	.403	[illegible]
C-10	5 by 7	.044	.022	.056	.029	.066	.037	.140	.078	[illegible]	.267
C-5	6 by 8	.015	0	.023	.005	.030	.007	.125	.071	[illegible]	.288
C-10	6 by 8	.024	.014	.029	.023	.037	.029	.158	.134	.506	.435
		.023	.009	.037	.014	.046	.018	.146	.089	.377	.338
Average		.016		.025		.032		.117		.357	
D-5	5 by 7	.011	.017	.018	.023	.027	.035	.132	.127	.336	.323
D-10	5 by 7	.036	.051	.040	.055	.060	.057	.176	.160	.349	.337
D-5	6 by 8	.030	.046	.035	.052	.060	.048	.168	.162	.380	.407
D-10	6 by 8	.025	.020	.030	.030	.035	.037	.167	.142	.353	.316
		.025	.033	.031	.040	.045	.044	.161	.148	.354	.346
Average		.029		.035		.044		.154		.350	

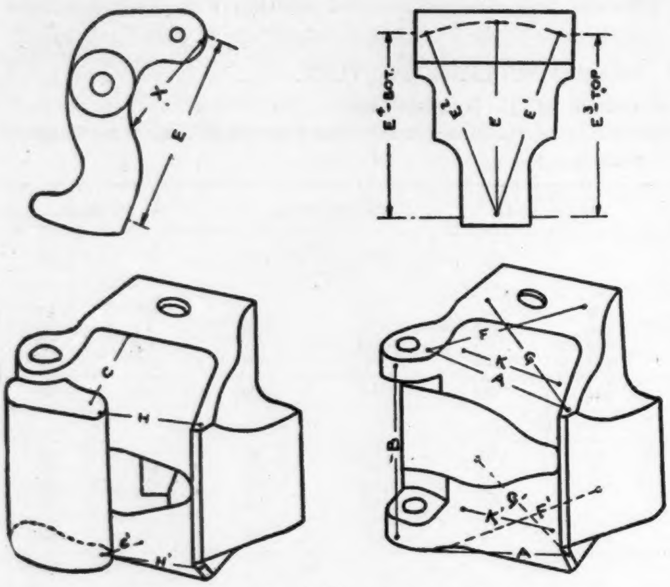
Coupler and Contour.	Size of Shank. (Inches.)	At 150 000 Lb.			At 175 000 Lb.			At 200 000 Lb.			At 300 000 Lb.			At 400 000 Lb.		
		E	E1	E2	E	E1	E2	E	E1	E2	E	E1	E2	E	E1	E2
C-5	5 by 7	0	0	0	0	0	0	0	0	0	.065	.065	.065	.223	.204	.219
C-10	5 by 7	0	0	0	0	0	0	0	0	0	.016	.016	.016	.112	.112	.112
C-5	6 by 8	0	0	0	0	0	0	0	0	0	.023	.023	.023	.144	.144	.141
C-10	6 by 8	0	0	0	0	0	0	0	0	0	.037	.043	.037	.200	.212	.177
		0	0	0	0	0	0	0	0	0	.035	.038	.035	.170	.168	.162
Average			0			0			0			.036			.167	
D-5	5 by 7	0	0	0	0	0	0	.014	.014	.014	.153	.153	.153	.262	.260	.259
D-10	5 by 7	.015	.015	.015	.016	.016	.016	.018	.018	.018	.098	.084	.073	.247	.235	.221
D-5	6 by 8	0	0	0	.003	.003	.003	.008	.010	.008	.098	.098	.076	.276	.249	.242
D-10	6 by 8	0	0	0	.008	.008	.008	.012	.012	.012	.110	.110	.099	.301	.275	.260
		.004	.004	.004	.007	.007	.007	.018	.013	.013	.115	.111	.100	.271	.255	.245
Average			.004			.007			.015			.109			.257	

SUMMARY STATIC GUARD ARM (Hb) TEST.

Types C and D Experimental Standard M. C. B. Couplers.

Coupler and Contour.	Size of Shank. (Inches.)	Permanent Set, In.								Ultimate Load. Lb.
		At 150 000 Lb.		At 200 000 Lb.		At 300 000 Lb.		At 350 000 Lb.		
		A	A′	A	A′	A	A′	A	A′	
C-5	5 by 7	.005	0	.030	.030	.237	.235	.426	.437	397 020
C-10	5 by 7	.025	0	.055	.008	.230	.163	.417	.345	429 200
C-5	6 by 8	.013	0	.029	.005	.185	.163	.344	.317	446 460
C-10	6 by 8	.040	0	.055	.024	.302	.314	.610	.554	400 000
Average		.021	0	.042	.017	.238	.219	.449	.413	418 170
D-5	5 by 7	.020	.005	.061	.038	.265	.241	.422	.397	386 400
D-10	5 by 7	.017	.020	.051	.029	.298	.295	....	....	322 180
D-5	6 by 8	.020	.011	.045	.034	.251	.231	.415	.372	388 680
D-10	6 by 8	.020	.007	.043	.057	.308	.334	.520	.534	450 000
Average		.019	.011	.050	.039	.280	.275	.452	.434	386 815
		K	K′	K	K′	K	K′	K	K′	
C-5	5 by 7	0	0	0	0	0	0	.020	.014	397 020
C-10	5 by 7	0	0	0	0	0	0	.025	.008	429 200
C-5	6 by 8	0	0	0	0	.005	0	.019	0	446 460
C-10	6 by 8	0	0	0	0	.007	.010	.060	.045	400 000
Average		0	0	0	0	.003	.002	.031	.017	418 170
D-5	5 by 7	0	0	0	0	0	0	0	.009	386 900
D-10	5 by 7	0	0	.010	0	.023	0	....	....	322 180
D-5	6 by 8	0	0	0	0	0	0	.015	.010	388 680
D-10	6 by 8	0	0	0	0	.010	.010	.027	.022	450 000
Average		0	0	.002	0	.009	.002	.014	.014	386 815

to the engaged pulling faces of the knuckles by compressing the two Class *F* springs (outside coils only) on the large bolts, which springs press against the steel block extending



Above Dimensions Were Trammed on Test Couplers According to Character of Test

through the yoke attached to each coupler. Each coupler is confined directly back of its striking horn in sliding castings or yokes which are pivotally connected to a driving rod and rocker crank, respectively, which, in turn, are attached to the crank pin of a cam on the end of separate driving shafts propelled by the pulleys which are belt-driven from a motor.

The cams on the ends of the driving shafts impart the movement to the couplers which are under tension. The sliding box confining one coupler is directly connected to its cam and has a lateral movement, and the sliding box confining the other coupler is connected to its cam through a rocker crank and has a vertical movement; while, in addition, the two pulley wheels are of different diameter, and therefore the driving shafts are not driven at the same speed. The lateral movement is 1¼ in. and the vertical movement 1⅞ in., with the butt ends of the couplers held practically rigid.

With the engaging knuckles thus moving, one laterally and the other vertically, a vibrating movement is imparted to the knuckle tails and through them a lifting or creeping tendency to the locks. Such a motion experienced in service would tend to cause a coupler lock to creep upward, but its engagement with an effective lock-to-the-lock would resist further creeping and prevent any possibility of unlocking under draft. Any release of tension on the knuckles, ever so momentarily, will cause a lock which has crept to drop to its normal locked position. Creeping upward of a lock occurs only under certain conditions and generally only during continued draft. The larger the clearance of a knuckle hub between ears of the coupler and the less the stability or anchorage of the knuckle tail, the greater will be the vibration. Locking surfaces or walls tapered vertically, widest at top, increase creeping tendencies; this was proven in the experiments in service with couplers having wedge-shaped locks.

The two Type *C-5* and two Type *D-5* couplers used in the tests on the service machine, immediately preceding these tests, were also used in the lock-creeping tests. In order to definitely record on a chart the amount or distance the locks crept, the locks were drilled and tapped on top to receive a ⅝-in. threaded rod or staff, near the top of which a recording pencil was provided. The coupler heads were drilled and

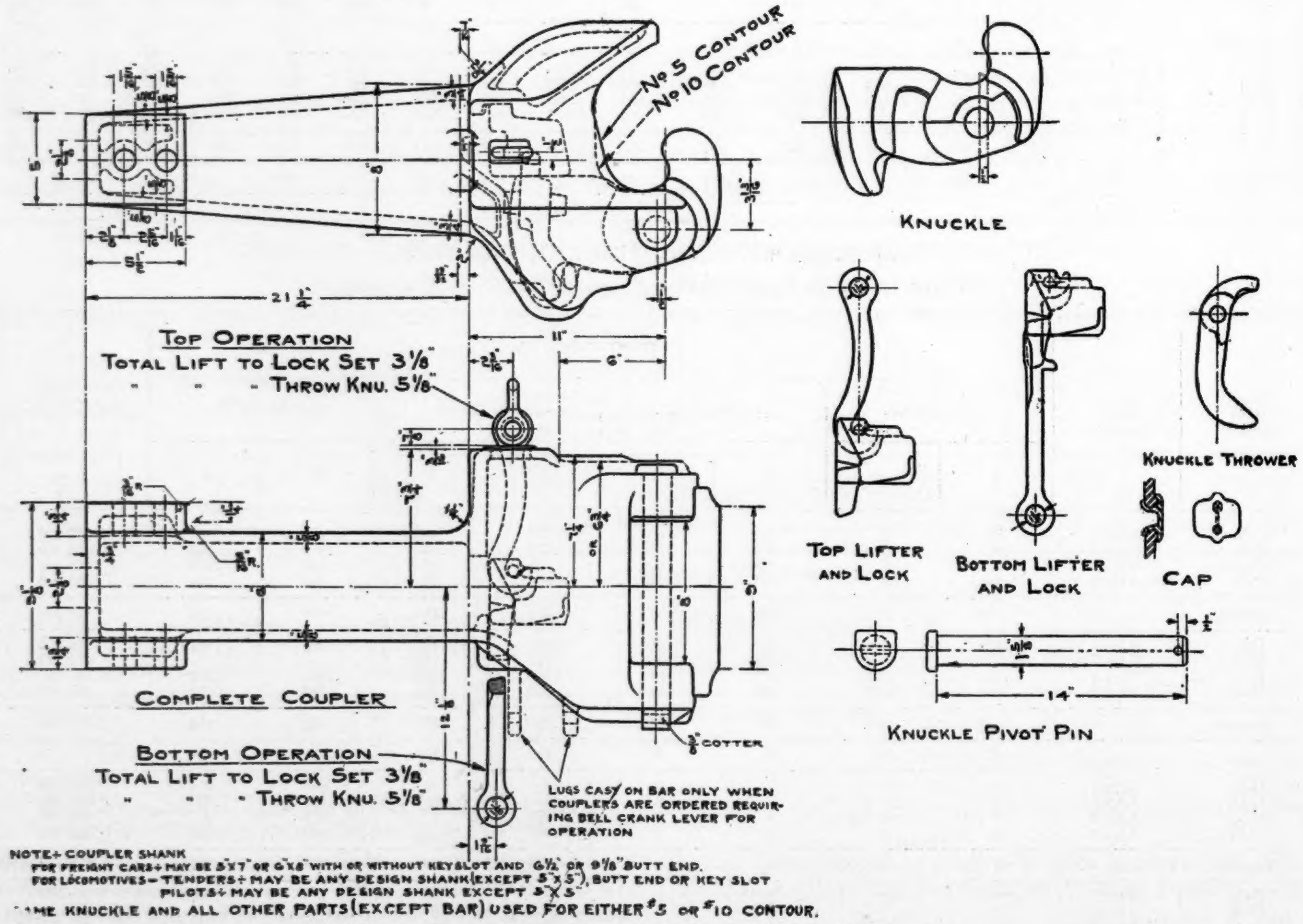


Fig. 1.—Experimental Standard M. C. B. Coupler, Type C

tapped to solidly support a wooden block on which the charts were tacked. As a matter of uniformity, the bottom-operating coupler was placed on the laterally moving end of machine and the top-operating coupler on the vertically moving end of machine in all the tests. Any lubrication remaining on the couplers from the service-machine tests was not wiped off. The results of these tests are shown in Fig. 3.

Owing to the defects revealed in the design of the Type *C* coupler in the tests on the service-testing and lock-creeping machines, the American Steel Foundries requested that they be permitted to make the following changes:

Changes to knuckle thrower so that the lock will go to lock-set position before engaging knuckle thrower. (In the present design the lock engages knuckle thrower about ½ in. before lock gets to lock-set position, and hence weight of knuckle thrower assists lock to lock-set position.)

Changes to side wall of coupler head to provide additional clearance for the knuckle-thrower.

Changes to the bottom pulling rib on coupler head to prevent interference with the knuckle thrower.

Changes to coupler head to make the lock underlie the anti-creep ledge while in the normal locked position. (In the present design the lock does not underlie the anti-creep ledge while in the normal locked position.)

This matter was given due consideration at a meeting of the committee and it was unanimously decided that these changes could not be authorized, as it would require resubmitting the Type *C* coupler to the tests to ascertain if the changes requested would correct the trouble or whether new difficulties would develop.

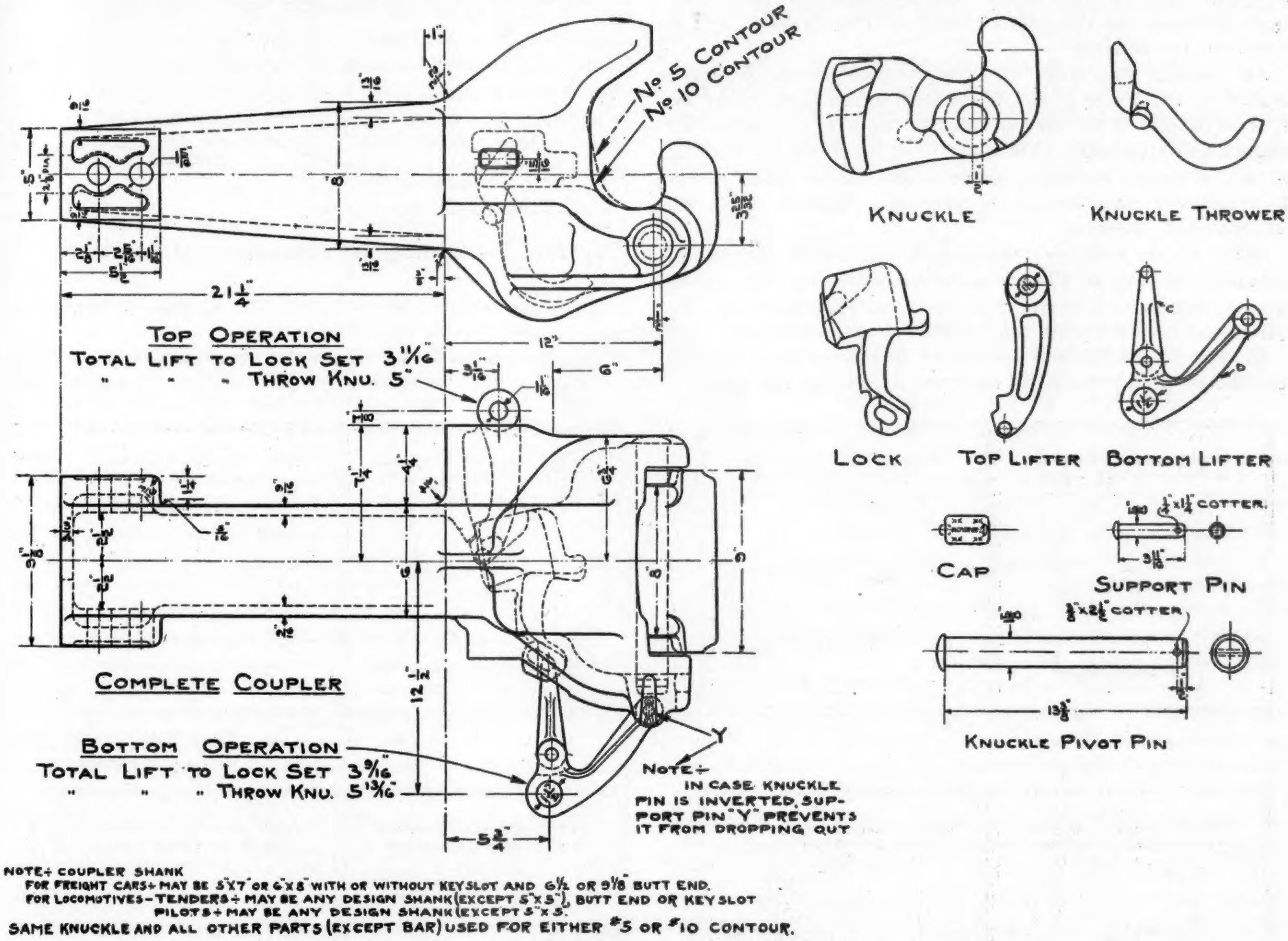


Fig. 2.—Experimental Standard M. C. B. Coupler, Type D

CONTOUR LINES

Experimental standard couplers with both No. 5 and No. 10 (square-face) contour lines have been in service since January, 1914, and up to the present time no difficulty has been experienced with either lines; but a direct advantage is had in service with the No. 10 lines when used in pushing on grades.

During the month of August, 1915, the committee, acting jointly with the American Steel Foundries and the National Malleable Castings Company, revised both the No. 5 and the No. 10 lines so that the same knuckle can be used with either lines, which was accomplished without detriment to the degree of angling. These revised lines are shown in Fig. 4. All *C* and *D* couplers embody the revised contours. Inasmuch as the knuckle and all internal parts in the head are interchangeable with coupler bodies having either the No. 5 or No. 10 revised lines, it will cause no inconvenience in holding in abeyance the selection of the lines for adoption as Standard.

ANGLING AND COUPLING TESTS

Tests were made with the revised Nos. 5 and 10 contour lines on the angling and coupling machine located at the works of The National Malleable Castings Company. They were conducted in the same manner as described in the 1913 Proceedings, pages 183 and 184. The changes made to the Nos. 5 and 10 lines were slight and, therefore, there was but little difference in the results.

In addition to the foregoing, tests were made with the revised No. 5 and No. 10 lines coupling to M. C. B. (1904) contour embodied in worn couplers having spring-actuated locks. Variable results were obtained, depending upon the design of knuckle tail and spring mechanism in the M. C. B. (1904) contour couplers. The M. C. B. spring-lock couplers were also tested mating with each other. The results of the No. 10 contour coupling to the spring-lock M. C. B. couplers was quite satisfactory, even though a little momentum was required to close knuckle of the latter. Momentum was never

required to close the No. 10 contour knuckle. The No. 5 contour coupling with one type of the M. C. B. spring-lock coupler was satisfactory, except when both knuckles were open and sometimes when the M. C. B. alone was open, due to knuckle nose and heel wedging between face and guard arm or knuckle tail and guard arm of mating coupler. A similar condition was present with two of this particular type M. C. B. spring lock couplers tested with each other, and under certain conditions they required a little momentum to close knuckle.

SELECTION OF STANDARD COUPLER

After the 1915 convention, a number of conferences were held between representatives of the Coupler Committee, the American Steel Foundries and the National Malleable Castings Company on the detail design of the Types *C* and *D* couplers, respectively.

An attempt was made to have the two companies represented by the Types *C* and *D* couplers agree upon either the *C* or *D* coupler to be recommended to the next convention for adoption as standard. This to be based upon ease of molding, fitting, strength, operation, patents, etc., all of which should be taken into consideration in reaching a decision. This was unsuccessful, however.

When all the tests were completed, and results plotted and tabulated, a copy of them was forwarded to all the coupler manufacturers and members of the Coupler Committee. Replies were received from four of the six manufacturers.

On May 26 the Coupler Committee went over very minutely the details of the results of the tests, as well as the design of the *C* and *D* couplers, and after a thorough consideration of all the points involved, decided:

"That the Type *D* Experimental Standard M. C. B. Coupler is unanimously recommended by the Coupler Committee for adoption as the Standard M. C. B. Coupler by the Master Car Builders' Association."

The reasons are as follows:

Dynamic Strike Test.—*D* coupler excels.

Dynamic Guard Arm Test.—*C* and D couplers equal in strength, but *D* coupler excels in operation.

Dynamic Jerk Test.—*D* coupler excels.

Static Pulling Test.—*D* coupler excels in location of fracture and knuckle pin deflection, whereas *C* coupler excels in permanent set at *E* dimension of knuckle. Other features equal.

Static Guard Arm Test.—*C* coupler excels.

Service Machine Tests on Operation.—*D* coupler excels, as it fulfilled tests satisfactorily, whereas *C* coupler revealed defects requiring changes.

Lock-creeping Tests.—*D* coupler excels, inasmuch as it fulfilled tests satisfactorily, but lock in *C* coupler crept past lock-to-lock, and therefore latter failed to perform its function.

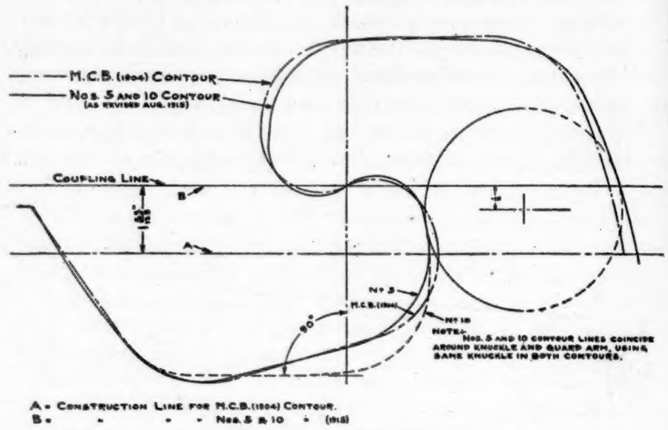
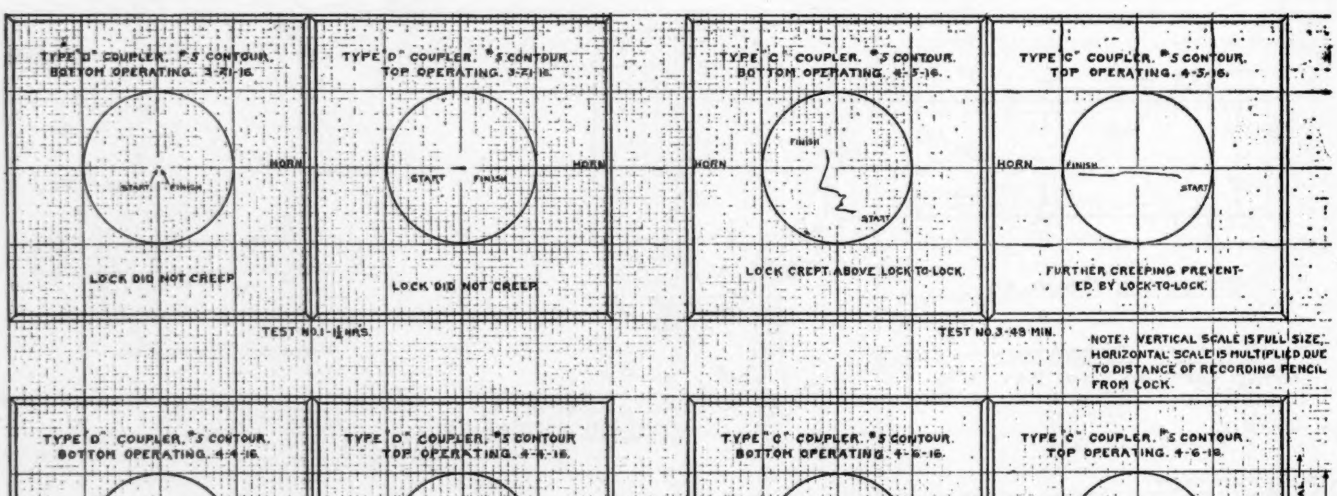


Fig. 4.—Superimposed Comparison of Contours



In all tests the bottom operating coupler was mounted on the laterally moving end of machine and top operating coupler on the vertically moving end of machine

Fig. 3.—Chart Showing Results of Lock Creeping Tests

CONCLUSIONS

With the adoption of the Master Car Builders' Standard Coupler, it is but reasonable to anticipate that this coupler will, the same as any coupler heretofore used, after some years' service, develop defects which will require correction, and it will therefore be advisable for all the members of the Association to follow the performance of the Standard Coupler closely and give to the committee the benefit of any developments.

DISCUSSION

F. W. Brazier, (N. Y. C.): Within six weeks I was on one of our fast trains, composed exclusively of pullman cars that broke in two in three parts just outside of our Albany station, which, as most of you know, is on a bridge. I got up and upon examining the cars found that one safety chain that held enough so that when the switching engine came down it was possible for that engine to haul the cars. There were seven or eight different knuckles at hand, but we could not get one to fit, and we had to pull the train back to the Albany station before we could get the right knuckle. If we had but one design of knuckle, or one design of coupler, which any knuckle would fit, we would have had no trouble. We would be able to do away with the practice of carrying thousands of couplers which are being held to-day for repair parts. In my opinion this committee has done one of the most important works in railway service that has ever been done by any committee in connection with the railways of this country. We will find that possibly the weight of the coupler can be reduced, but we are on the right track.

J. J. Hennessey, (C. N. & St. P.): I move that there be a rising vote of thanks extended to Mr. Kleine and the committee for the excellent report which they have presented on the coupler.

(The motion was unanimously carried by a rising vote.)

J. A. Pilcher, (N. & W.): I move that a vote of thanks be extended to the manufacturers of couplers for the work they have done in connection with the work of the Coupler Committee.

Mr. Kleine: The coupler manufacturers, all six of them, when we started this work began to labor with us, and they have since labored with us day and night, and the part which they have done on the work of bringing about a standard coupler has been appreciated by the Coupler Committee very much.

(Mr. Pilcher's motion was unanimously adopted.)

(A motion made by Mr. Milligan, to the effect that the recommendations of the committee be submitted to letter ballot with a view to adopting the coupler as standard for the M. C. B. Association, was carried.)

Report of Committee on Draft Gear

The work outlined to be carried out by the draft gear committee this year was: (1) To determine the maximum end force that could be put on the underframe of a freight car without over-straining it. (2) To find out at what speed this force is obtained with modern cars by taking readings with the Berry strain gage on the underframes of the cars before and after switching them together. (3) To determine the capacity of the draft gear and keep the impact force below the point of over-straining of the underframe at reasonable switching speeds. The first of these problems has been partially solved and this year's report deals with the work done and the results obtained. It has been found that immediately after the draft gear goes solid the force increases to the elastic limit of some part of the underframe structure, the draft gear connections, the draft gear or the coupler.

Prof. L. E. Endsley, Chairman

The committee consists of Prof. L. E. Endsley, chairman, University of Pittsburgh; W. E. Dunham, supervisor of motive power and machinery, Chicago & North Western; J. R. Onderdonk, engineer of tests, Baltimore & Ohio; A. R. Kipp, mechanical superintendent, Minneapolis, St. Paul & Sault Ste. Marie; G. W. Rink, mechanical engineer, Central of New Jersey; P. F. Smith, Jr., superintendent of motive power, Pennsylvania Lines; J. C. Fritts, master car builder, Delaware, Lackawanna & Western.

The report of the committee this year deals with experiments made to determine the maximum end force that could be put on the underframe of freight cars without overstraining them. Through the courtesy of the Union Draft Gear Company, the committee secured the use of its testing laboratory and 15,000-lb. pendulum hammer. This hammer is so equipped that it can be raised to any desired height and allowed to drop against a 30,000-lb. car that rolls on a straight level track. A photographic reproduction of the hammer and car is shown in Figs. 1 and 2. A drawing of the sills and end of car is shown in Fig. 3. Fig. 1 shows the end of the 15,000-lb. pendulum hammer at *A* and the 30,000-lb. car at *B*, the channels under test at *C* and the recording apparatus at *D*. The recording apparatus was made up of a revolving drum 10 in. in diameter and 30 in. long. This drum was mounted on ball bearings and was driven by a shunt-wound six-volt motor that had for all practical purposes a constant speed. The speed of the drum varied from 65 in. to 66.6 in. per second. A pencil mounted in a slide that was carried on two parallel rods recorded the movement of the 30,000-lb. car by means of connection *G*. That is, if the car was standing still, the pencil made a line around the drum perpendicular to the axis of the drum, but if the car made any movement, this pencil would move off from the starting line, thus recording the position of the car after any interval of time.

Method of Testing.—The method of testing was to mount some form of draft gear in the space *X* of Fig. 2 and place the car so that the tup of the hammer stood against the improvised coupler shank with the pendulum hammer at its lowest point. The hammer was then raised to the desired height by the means of a large electrical magnet and the recording drum started with the pencil in contact with the paper; the hammer was dropped and in this way any movement of the car was recorded on the paper. Besides the records obtained on the drum, readings of a 10-in. Berry strain gage were taken at ten points on each of the channels before the first blow was struck, and after any blow that was thought would give *permanent set* in the sills. These readings were taken as shown in Fig. 4 on the flange and under web. It will be seen that the cover plate is on the bottom and the tie plate is on the top. This was done in order to easily get between the channels to take Berry strain gage readings. Two readings were also taken on the top of the tie plate.

Channels Tested.—Seven sets of channels in all were tested. All the channels were 12 in. deep, and five had a weight of 25 lb. per ft. The cross-sectional area was 7.35 sq. in. each, making a total of 14.7 for the two channels. The other two had a weight of 40 lb. per ft., a total cross-sectional area of 23.52 in. The cover and tie plates were 5/16 in. thick. The detail of the construction is well shown in Fig. 4. It will be seen that the channel was butted square up against the end of the car and held by bolts, merely to hold the channels in

position. The draft gear lugs had ten ⅞-in. rivets driven in 15/16-in. holes.

Draft Gears Used.—Four draft gears were used and will be referred to as *A, B, C, D* and *E; E* being a combination of two *C* gears, one mounted on the hammer and one in the car. The gears selected were of different capacity and are lettered in the order of their capacity, *A* being the lowest capacity. Read-

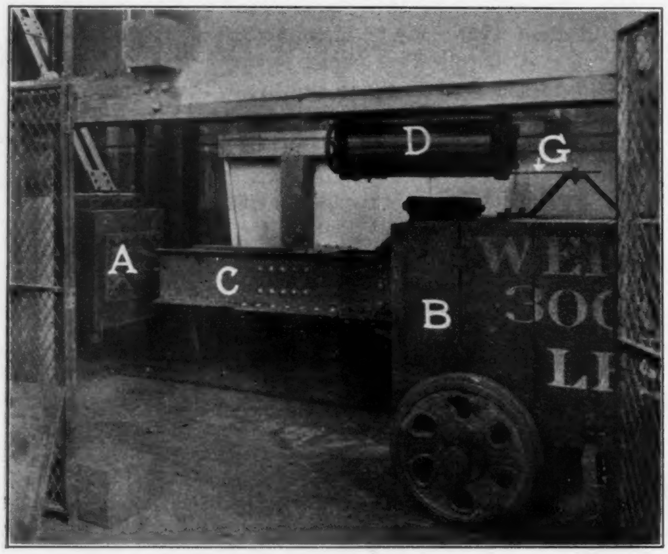


Fig. 1.—Pendulum Hammer and Test Car for Testing Draft Sills

ings of the Berry strain gage were made after each drop on the first set of sills tested. It was found that no set was produced in the sill until the draft gear under test went solid, so that for the remaining tests, readings were only taken before the test began and after the drops that closed the gears. These readings of the Berry strain gage were taken until the eye could see the distortion of the sills, when the readings were discontinued.

Method of Obtaining the Maximum Force on the Sills.—The method of obtaining the maximum force on sills was accom-

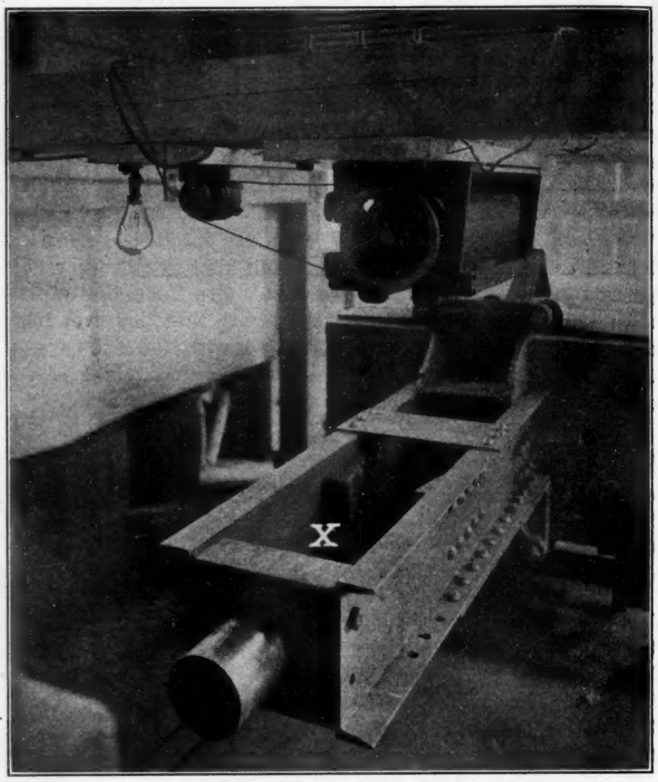


Fig. 2.—A Draft Sill Applied to Test Car

plished by a graphic solution of the curve drawn on the drum. The undisputed law of physics, that force equals mass times

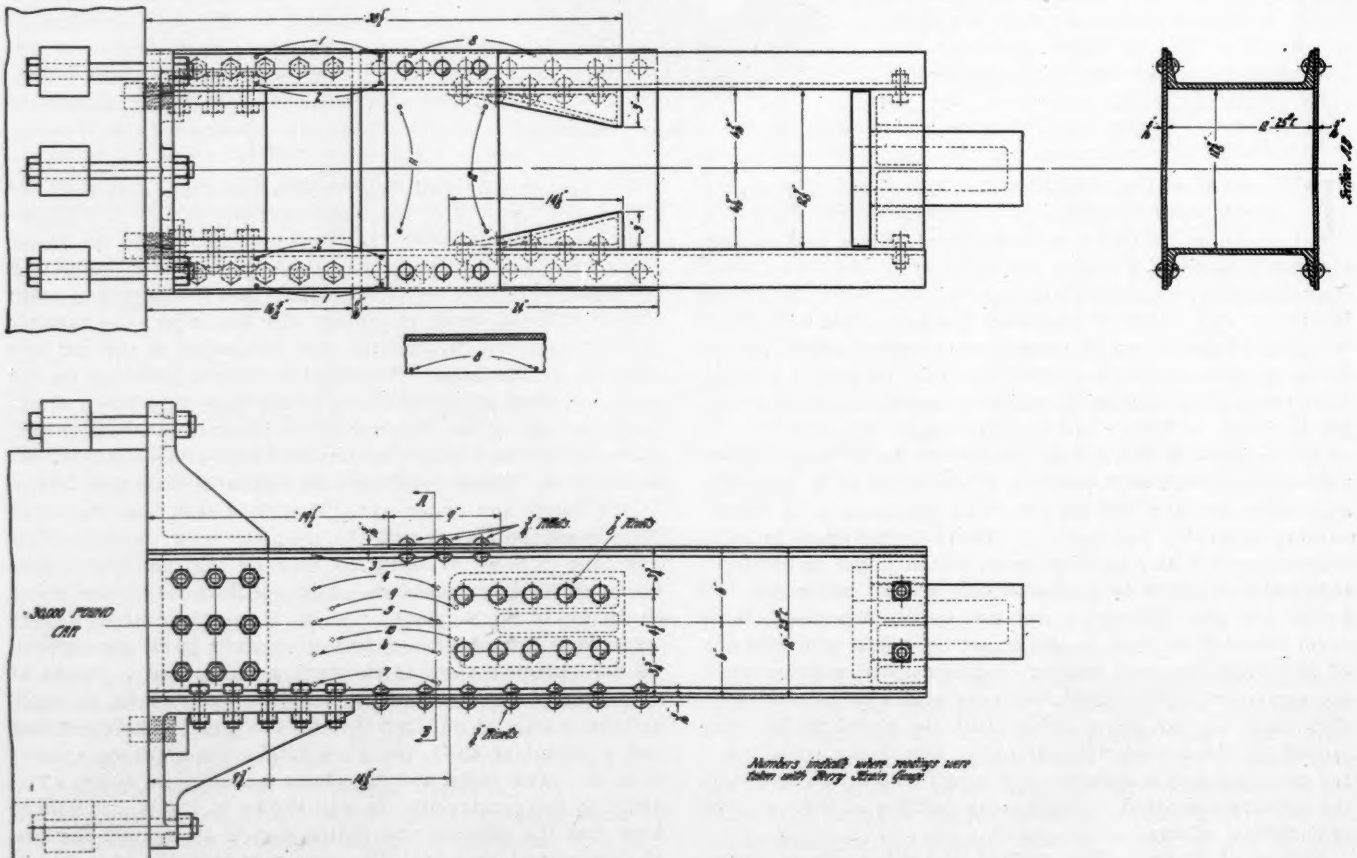


Fig. 3.—General Drawing of Draft Sill Showing Gage Points

acceleration, was employed and the acceleration of the car in feet per second per second obtained, and multiplying the acceleration by the mass gave the force. The speed of the drum being approximately 65 in. per second, the velocity of the car was determined for each $1/100$ of a second. This gave points on the curve .65 in. apart, and the difference in the velocity of $1/100$ would give the acceleration per $1/100$ of a second. This acceleration was then reduced to second per second and the following formula applied:

$$F = \frac{W}{g} \times a$$

in which F equals the force in pounds on the car sills and W equals the total weight of the car including sills; g equals gravity taken as 32.2 and a equals acceleration in feet per second per second as obtained from the curve.

Results.—Table I gives the maximum pressure produced on

HEIGHT OF DROP OF 15000# HAMMER	MAXIMUM PRESSURE DURING IMPACT LB. 14.7 SQ. IN. SILLS					23.52 SQ. IN. SILLS	
	GEAR A	GEAR B	GEAR C	GEAR D	GEAR E	GEAR A	GEAR C
I	II	III	IV	V	VI	VII	VIII
2	40000	45000		61400	38900	35800	52000
4	52800	72300	44600	66800	50500	45700	69200
6	77600	107000	54600	84700	50700	102000	73600
8	330000	157000	67400	96500	57600	429000	84700
10	459000	185000	71600	108000	60600	647000	112000
12	502000	189500	87200	101000	66100	779000	127000
14	593000	193000	96800	109000	71600	855000	130000
16	603000	247000	114300	95000	72400	830000	129000
18		466000	125400	100000	77000	860000	130000
20		530000	153000	109500	88600		133000
22		562000	326000	109500	87100		186000
24		595000	408500	97300	91000		367500
26		573000	442500	99600	94100		655000
28			466500	99500	107200		756500
30			497500	106500	103800		765000
32			596000	144000	89500		800000
34			602000	178300	104000		811500
36			590000	287500	117500		873000
38				469000	120000		
40				497000	123000		
42				545000	151000		
44				610000	177000		
46				565000	440000		
48					351000		
50					479000		
52					550500		
54					595000		
56					572000		

Table. I.—Impact Pressures Applied to the Tested Sills

NOTE.—The heavy black dividing line in the columns shows at what pressure the gear went solid. The double line shows where the permanent set in the channels was first noted. The final impact in the test of the heavy sills sheared off one lug.

each channel at the different heights with different gears. Table II gives three dimensions of each set of sills after the last blow. Column I gives the kind of channel; Column II gives the gear; Column III gives the distance over all of the flanges of the right channel locking on the car at the center of the tie plate. The tension on the tie plate always caused the channel flange to bend up at this point. Column IV gives the same as on the left channel; Column V gives the distance between the webs at the back end of the draft lugs. In looking at these figures some might get the idea that this was the only failure, but the Berry gage showed upsetting of the entire channel at the heaviest blows.

The maximum pressure produced at each height is plotted against the height of the drop in Fig. 4 for the light channel and in Fig. 5 for the heavy channel.

Discussion of Results.—It will be seen from the results here given that the maximum end force on two 12-in., 25-lb. channels is approximately 600,000 lb., but that a force of approximately 450,000 lb. will cause the channel to be overstrained. This is about what it would figure if we assumed 30,000 lb. per sq. in. as the elastic limit and assumed each square inch of material to be doing an equal amount of work. While on the heavier channels the maximum of the channel capacity was not reached for the lugs sheared at about 850,000, and should

CONDITION OF CHANNELS AFTER TEST				
CHANNEL	GEAR	DISTANCE ACROSS OUTSIDE OF CHANNEL FLANGE AT CENTER OF TIE PLATE INCHES		DISTANCE BETWEEN CHANNELS AT END OF LUGS INCHES
		RIGHT	LEFT	
I	II	III	IV	V
LIGHT	A	$12\frac{1}{2}$	$13\frac{1}{4}$	$14\frac{5}{16}$
LIGHT	B	$13\frac{3}{8}$	$13\frac{3}{8}$	$14\frac{5}{8}$
LIGHT	C	$12\frac{1}{2}$	$12\frac{1}{2}$	$13\frac{3}{8}$
LIGHT	D	$12\frac{7}{16}$	$12\frac{15}{16}$	$14\frac{1}{16}$
LIGHT	E			
HEAVY	A	$12\frac{3}{16}$	$12\frac{3}{16}$	$13\frac{1}{8}$
HEAVY	C	$12\frac{3}{16}$	$12\frac{1}{4}$	$13\frac{1}{8}$
MEASUREMENT OF ALL BEFORE TEST		12	12	$12\frac{7}{8}$

Table II

these heavy channels stand the same proportion to the light ones, the maximum pressure would be approximately 960,000 lb. The overstrained point on the heavier channels was, however, obtained, and shows that probably a little over 700,000 would strain the channel above the elastic limit.

By looking at the curve in Fig. 4 it will be seen that all the channels failed at about the same maximum pressure of approximately 600,000 lb., and that they all began to show give

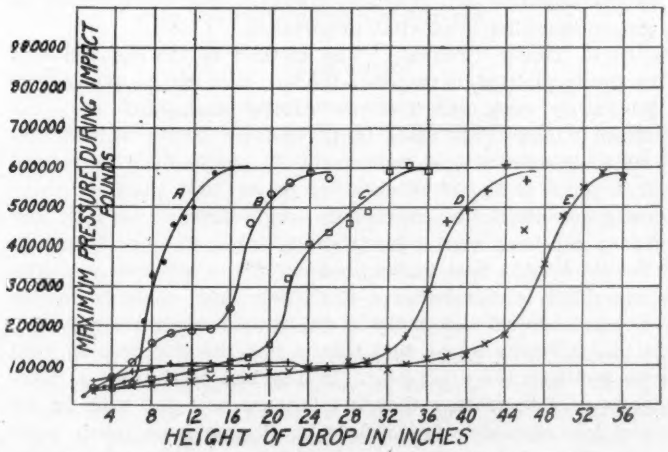


Fig. 4.—Maximum Pressures for the Light Sills

at 450,000 lb., or a little less. By referring to Table I it will be seen that this point is always reached in from 2 to 4 in. higher drop than that which made the gears go solid. This, in other words, means that if you have a draft gear in a car that goes solid before all the energy is absorbed or transmitted to the next car, the pressure is going to the strength of the under frame immediately. It only took about 5,000 ft.-lb. of energy to do this in this case. Now, if the sills are heavy the

result would be as plotted in Fig. 5. Here it will be seen that only a 6-in. increase in height of the hammer above that required to close the gear strained the sill to over 700,000 lb. That 7,500 ft-lb. of work more than that which was necessary to close the gear, ran the pressure up to 700,000 lb., while the pressure in no case before the gear went solid was 200,000.

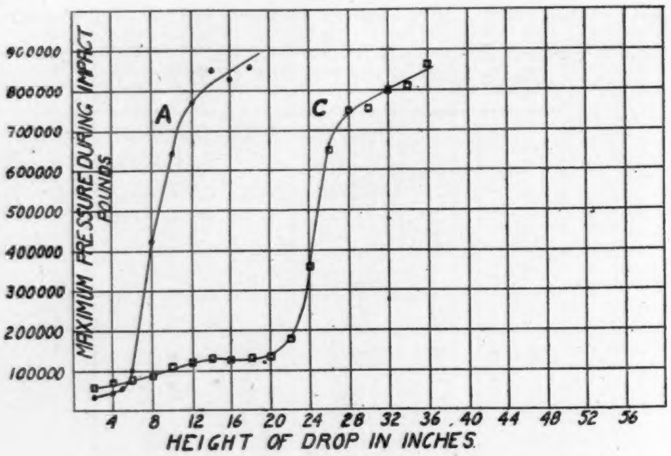


Fig. 5.—Maximum Pressures for the Heavy Sills

From the foregoing it must follow that the opinion of the committee is that we want a draft gear that will absorb enough of the energy to keep the pressure down below the elastic limit of the sills. The committee wishes to call to the attention of the association that ten rivets were sheared off in two of the tests and that they believe that a longer lug with more rivets in it should be provided by the association in the M. C. B. lug.

DISCUSSION

F. H. Stark, (Montour): It seems to me that the transportation department ought to be consulted, and an effort made to get the railways to reach a point of reasoning that it is useless to increase the dead weight of our rolling stock only to have it destroyed by careless handling. While I appreciate that it is important that we have the best friction gear that is possible and that our car design be brought up to the scientific and practical standard, yet the question of proper handling is of vital importance.

C. D. Young, (Penna.): The method of testing, followed by the committee, is probably the best that can be devised for laboratory work, but it is not strictly comparable with the action which takes place in the service to the sills of the car with reference to end shocks. I am inclined to believe that some of the rivet shearing which took place in these tests was due to the type of the angle back of the sills, and had a car been used with the full length of sills, the rivets would not have been called upon to take so much strain. The committee is suggesting a draft gear with a minimum absorption capacity of 25,000 ft.-lb., with a minimum travel of 4 in. It seems to me that this is just the converse of what we desire in the draft gear. If they had established a maximum of 4 in., rather than a minimum of 4 in., with an absorption capacity of 25,000 ft.-lb. it would be much more desirable. I feel that we should keep the travel of the gear down as low as we can, consistent with the necessary capacity of the gear to protect the sills.

Prof. Endsley: It will be almost impossible with the present strength of underframing to get a draft gear under 4 in. that will absorb 25,000 ft-lb., because you have only 1-3 ft at 4 in. travel—and to get 25,000 ft.-lb. absorption, you have got to go to a very high final pressure, a pressure above 450,000 lb. It is not a question of what we would like to have, but a question of what is possible to get. I know that the manufacturers of draft gears can furnish draft gears of low and high capacity, and can furnish them for either short or long travel. We do not say that is going to be the standard, but we do need some information along the lines of the proposed draft gear. We know that in our test this year that draft gears that gave exactly the same final pressure as those reported would close the gear at different heights, merely due to the increased travel.

The subject of trying this out on a full car, I will say that the draft gear committee has had offered to it a plant at the Symington Company at Rochester, where we can switch in full-sized cars and test the gear under the same as working conditions. I grant that two inches of travel would be a nice thing, but last week I stopped at the head of a train, at an engine, pulling it up grade, the train stopped stretched, and with no draft gear solid in any of the cars except one, and it was one I did not measure. I found that we had the horn of the coupler standing at as much as 6½ in. on a car that was four years old. In other words, we had 4 in. and more than that on that car that was made to have 2⅛ in. It is not a question of keeping the travel down. It is a question of keeping some travel. We are unable today to keep the travel, because of straining the connections. We can go along the cars today and we will not find an end sill but what it is bent in from a small amount to as much as five inches. It is a question of the sills digging out through the horn of the coupler, and we were going after something that we thought would do something with the draft gear question. I would be glad myself if we could do it with less travel. The committee at a recent meeting of all the members except two, unanimously decided that they were in favor of trying this out, and I hope to have some very valuable information next year on the subject of a four inch or more travel with the absorption of 25,000 ft.-lb. of energy.

My personal opinion is that a draft gear should absorb one-quarter of the energy of the rolling car. I mean by that that if a car is going 4 m. p. h. and strikes a car standing still, it will produce in a standing car approximately one-half of its speed, or in other words put into the standing car one-quarter of the energy in the rolling car, because the energy is proportional to the square of the velocity. It will retain one-quarter and coast on down with the second car, but one-half of the energy is gone. It must be absorbed in the draft gear or in some part of the underframe, but you cannot destroy the energy without absorbing it at some place.

J. J. Hennessey (C. M. & St. P.): I move that the committee be continued for another year. It might be well for it to give consideration to the amount of travel that we can have in a car without putting the air hose in danger of becoming uncoupled.

A. R. Ayers (N. Y. C.): I would like to call attention to a few things which might want to be looked into the coming year. Assuming that we have a draft gear that will absorb one-quarter of the energy of a moving car, that will cover the situation at a certain speed. Above that speed the underframes of the two cars will have to take care of a sufficient force to start the standing car, and that force is very largely affected by the speed of the moving car. The energy to be absorbed in the car moving 6 m. p. h. is in the neighborhood of 160,000 ft.-lb. The characteristics of a friction draft gear varies in different gears. As to the final resistance of the gear, that is. You may have a friction gear that will absorb say 10,000 ft.-lb. of energy, but the diagram of test of such a gear will show you a final resistance of 300,000 or 400,000 lb., we will say. The underframe of the car, in order to absorb that 10,000 ft.-lb., has also to withstand the 400,000 lb. final blow. Another gear may absorb 10,000 ft.-lb. of energy with the final resistance of only 200,000 lb., and it does not require any imagination to figure which gear is easier on the car.

There is still another question on which I have never seen information. That is, at what time does the standing car commence to move? That is a very important factor in

taking care of blows made at higher speeds than say 4 m. p. h. If you have a draft gear that will start the car moving when its travel is only half exhausted, you are going to be able to take care of a greater blow than with a gear which waits until its travel is completely gone until it starts to move that car.

F. F. Gaines, (C. of G.): There is just one item of this report that I find missing. That is a comparison of the spring draft gear with the friction gear, which, to my mind, is one of the important features to be considered, and I think that the committee next year should, in making tests, take the largest capacity standard M. C. B. spring gears, and show us what happens to a car equipped with them. I make that as an amendment to the original motion.

J. A. Pilcher, (N. & W.): In this discussion the whole thought has been directed towards striking a train of cars with a moving car. You will notice that this does not take up the question of the operation of the train in the regular service, but takes up the question primarily of the yard service.

The question of train service is, of course, a question of the relative movement of cars in the train under any conditions that may arise in the operation of the train, such, for instance, as a burst hose and the emergency application of the brakes. I do not know just what the variations of speed are, under those conditions, but I have an idea that the increased travel of the gear is going to have its influence upon the relative motion between cars in the train, and in this way affect the final force that is to be exerted by one car upon another. I think if this report simply brings out prominently the fact that there is a limit to the speed at which cars can be brought together without doing damage, it will have served a great purpose.

(Mr. Hennessey's motion, as amended, was carried.)

Report of the Committee on Safety Appliances

This committee has been in existence since 1908; it was made a standing committee as the result of the recommendation of the special committee on "Standards for the Protection of Trainmen" which was presented at the 1908 convention. The committee has thoroughly revised the safety appliances standards of the association as they then existed, and since the passage of the present federal safety appliance law in 1910 its work has consisted largely in bringing about a general understanding of the requirements of the law and keeping the association's members in touch with the government authorities. President MacBain is chairman of the committee. The other members are D. F. Crawford, general superintendent motive power, Pennsylvania Lines West; C. E. Fuller, superintendent motive power and machinery, Union Pacific; C. B. Young, mechanical engineer, Chicago, Burlington & Quincy; H. Bartlett, chief mechanical engineer, Boston & Maine; H. T. Bentley, superintendent motive power and machinery, Chicago & North Western, and E. A. Sweeley, master car builder, Seaboard Air Line.

FROM information received from the railroads operating 2,505,159 freight cars, of which, according to reports, 1,905,929 cars were put in service prior to July 1, 1911, between the periods July 1, 1911, and December 31, 1915 (the latest data available), 1,303,906 cars built prior to July 1, 1911, have been equipped with safety appliances, or an average of 289,757 cars per year. The actual total each year follows:

Half year ending December 31, 1911	37,667
Year ending December 31, 1912	223,137
Year ending December 31, 1913	331,846
Year ending December 31, 1914	338,321
Year ending December 31, 1915	372,935
	1,303,906

Of the cars built prior to July 1, 1911, there remained to be equipped on December 31, 1915, 681,571 cars.

To complete the equipment of these cars by the time set by the Interstate Commerce Commission will require a great deal of effort on the part of the railroads, especially in view of the difficulty of getting the cars home from foreign roads and the procurement of materials with which to do the work.

In order to expedite the movement of cars home for this purpose, the Arbitration Committee has proposed, with the approval of the Executive Committee, the incorporation in Rule 4 of the following:

"After January 1, 1917, no car will be received from owner unless properly equipped with United States Safety Appliances or United States Safety Appliances Standard."

"After April 1, 1917, no foreign cars will be accepted in interchange unless properly equipped with United States Safety Appliances or United States Safety Appliances Standard.

The committee feels that this matter should be given the closest attention possible, that there should be coöperation on the part of the railroads to the end that on July 1, 1917, we may say to the Interstate Commerce Commission that practically all of the cars in the country have been equipped in accordance with the requirements of the law.

DISCUSSION

(On motion, the report was accepted.)

The following letter, received by the president from chairman W. J. Jackson, of the Special Committee on Relations of Railway Operation to Legislation, was read:

"The special committee on Relations of Railway Operation to Legislation has called attention to the fact that on January 1, 1916, there remained approximately 681,571 cars built prior to July 1, 1911, which had not at that time been equipped with the United States Safety Appliance Standards.

"The time for the equipment of these cars expires July 1, 1917. A further extension of time it thinks cannot be obtained. It is therefore essential that the rate at which these cars are being equipped be somewhat increased over the rate during the past two years.

"As the penalty for the use of an unequipped car runs against the user and not against the owner, it is the suggestion to the committee, that at least six months prior to the effective date of the act, arrangements should be made whereby unequipped cars will not be received from their owners; this in order to avoid the dispersion of unequipped cars all over the country and their subsequent equipment by other than owning roads."

Report of Committee on Loading Rules

The report of the Standing Committee on Loading Rules covers the usual detail changes made in existing rules to meet new conditions. There are no completely new rules in this year's recommendations. In connection with the matter of interline loading there has been little accomplished during the year along the original program, but the committee has conferred with the American Railway Association sub-committee on the preparation of box cars for loading. The committee appreciates the response to its previous request that matters which do not seem to be fully understood be referred to it for explanation; at the same time the members feel that much more can be accomplished if the roads will give closer attention to the general observance of the requirements and let the committee have whatever criticisms or suggestions they may have to offer.

A. Kearney, Chairman

The committee consists of A. Kearney, chairman, assistant superintendent of motive power, Norfolk & Western; A. B. Corinth, general car inspector, Atlantic Coast Line; L. H. Turner, superintendent of motive power, Pittsburgh & Lake Erie; R. L. Kleine, chief car inspector, Pennsylvania Railroad; J. M. Borrowdale, superintendent of car department, Illinois Central; C. N. Swanson, superintendent of car shops, Atchison, Topeka & Santa Fe, and H. C. May, superintendent of motive power of the Lehigh Valley Railroad.

THE committee submits the following recommendations covering changes in the present Loading Rules.

Rule 2.—Change word "should" in second line to "must," and add paragraph reading as follows: "All bolts used in securing bearing pieces, sliding pieces, braces, etc., should have the ends riveted over to prevent the nuts from working off, or be secured by means of an effective lock-nut or nut-lock."

Rule 5.—Revised to make the specified side bearing clearances conform to present practices. This would make the rule read as follows: "Cars should be in such condition that

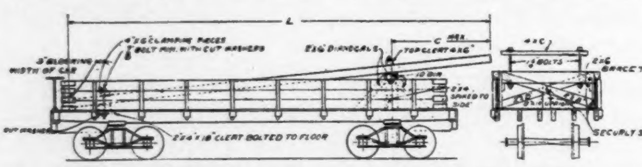


Fig. 34.—Rules 11, 31, 73, 76, 77, 79, 80 and 84. Overhanging Loads on Single Cars

the trucks can curve freely. The maximum side bearing clearance for loaded cars must not be more than 5/16 in. per side bearing for loads less than ten (10) ft. high from top of rail, and must not exceed 3/16 in. per side bearing for loads ten (10) ft. high or over, from top of rail."

Rule 7.—Change third sentence, first paragraph, to read: "Lading must not be placed on top of wooden cars having

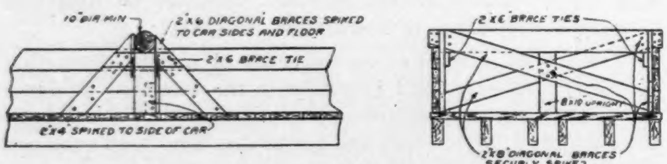


Fig. 41.—Rules 7, 80 and 81. Manner of Blocking Round Bearing Pieces, Low Side Gondola Cars with Sides 3 In. or more in Thickness

sides less than 3 in. thick, or steel cars having sides not of sufficient strength to carry the lading."

Rule 12.—Paragraph (a).—Change the first paragraph to read as follows: "Gondola cars not equipped with stake pockets to suit the required number and size of stakes should have the stakes placed inside of car side. Stakes may be placed on the inside of gondola cars having outside stake pockets, providing the stakes rest on the car floor and are substantially secured at the bottom ends and at the top of the car sides, to prevent shifting. When opposite stakes are tied together at the top and at one or more intermediate points with wire they need not be placed in the stake pockets or secured to the car sides."

Rule 24.—After the word "from" in fourth line, change the rule to read as follows: "six-tenths (6/10) to eight-tenths (8/10)" instead of "seven-tenths (7/10) to eight-tenths (8/10)" as the rule now reads.

Page 15.—Table has been revised showing the total length of lading, distance between bearing pieces, width of load, and the overhang for distances of 6/10, 7/10 and 8/10 of the total length of lading, for the location of bearing pieces. The revised tables are as follows:

DISTANCE BETWEEN BEARING PIECES SIX-TENTHS (6-10) OF TOTAL LENGTH OF LADING

Length of Load.	Distance between Bearing Pieces. D.	Width of Load between Bearing Pieces. W.	Length of Overhang. C.	Width of Overhang. W.
50 ft.	30 ft. 0 in.	9 ft. 6 in.	10 ft. 0 in.	9 ft. 1 in.
55 ft.	33 ft. 0 in.	9 ft. 4 in.	11 ft. 0 in.	8 ft. 11 in.
60 ft.	36 ft. 0 in.	9 ft. 3 in.	12 ft. 0 in.	8 ft. 8 in.
65 ft.	39 ft. 0 in.	9 ft. 2 in.	13 ft. 0 in.	8 ft. 6 in.
70 ft.	42 ft. 0 in.	9 ft. 0 in.	14 ft. 0 in.	8 ft. 3 in.
75 ft.	45 ft. 0 in.	8 ft. 10 in.	15 ft. 0 in.	8 ft. 0 in.
80 ft.	48 ft. 0 in.	8 ft. 8 in.	16 ft. 0 in.	7 ft. 8 in.
85 ft.	51 ft. 0 in.	8 ft. 6 in.	17 ft. 6 in.	7 ft. 5 in.
90 ft.	54 ft. 0 in.	8 ft. 4 in.	18 ft. 0 in.	7 ft. 2 in.
95 ft.	57 ft. 0 in.	8 ft. 2 in.	19 ft. 0 in.	6 ft. 9 in.
100 ft.	60 ft. 0 in.	8 ft. 0 in.	20 ft. 0 in.	6 ft. 5 in.
105 ft.	63 ft. 0 in.	7 ft. 9 in.	21 ft. 0 in.	6 ft. 1 in.
110 ft.	66 ft. 0 in.	7 ft. 7 in.	22 ft. 0 in.	5 ft. 8 in.
115 ft.	69 ft. 0 in.	7 ft. 4 in.	23 ft. 0 in.	5 ft. 3 in.
120 ft.	72 ft. 0 in.	7 ft. 1 in.	24 ft. 0 in.	4 ft. 10 in.

DISTANCE BETWEEN BEARING PIECES SEVEN-TENTHS (7-10) OF TOTAL LENGTH OF LADING

Length of Load.	Distance between Bearing Pieces. D.	Width of Load between Bearing Pieces. W.	Length of Overhang. C.	Width of Overhang. W.
50 ft.	35 ft. 0 in.	9 ft. 4 in.	7 ft. 6 in.	9 ft. 3 in.
55 ft.	38 ft. 6 in.	9 ft. 2 in.	8 ft. 3 in.	9 ft. 1 in.
60 ft.	42 ft. 0 in.	9 ft. 0 in.	9 ft. 0 in.	9 ft. 0 in.
65 ft.	45 ft. 6 in.	8 ft. 10 in.	9 ft. 9 in.	8 ft. 9 in.
70 ft.	49 ft. 0 in.	8 ft. 8 in.	10 ft. 6 in.	8 ft. 7 in.
75 ft.	52 ft. 6 in.	8 ft. 5 in.	11 ft. 3 in.	8 ft. 5 in.
80 ft.	56 ft. 0 in.	8 ft. 3 in.	12 ft. 0 in.	8 ft. 2 in.
85 ft.	59 ft. 6 in.	8 ft. 0 in.	12 ft. 9 in.	7 ft. 11 in.
90 ft.	63 ft. 0 in.	7 ft. 9 in.	13 ft. 6 in.	7 ft. 8 in.
95 ft.	66 ft. 6 in.	7 ft. 6 in.	14 ft. 3 in.	7 ft. 5 in.
100 ft.	70 ft. 0 in.	7 ft. 3 in.	15 ft. 0 in.	7 ft. 2 in.
105 ft.	73 ft. 6 in.	7 ft. 0 in.	15 ft. 9 in.	6 ft. 10 in.
110 ft.	77 ft. 0 in.	6 ft. 8 in.	16 ft. 9 in.	6 ft. 6 in.
115 ft.	80 ft 6 in.	6 ft. 5 in.	17 ft. 3 in.	6 ft. 3 in.
120 ft.	84 ft. 0 in.	6 ft. 1 in.	18 ft. 0 in.	5 ft. 11 in.

DISTANCE BETWEEN BEARING PIECES EIGHT-TENTHS (8-10) OF TOTAL LENGTH OF LADING

Length of Load.	Distance between Bearing Pieces. D.	Width of Load between Bearing Pieces. W.	Length of Overhang. C.	Width of Overhang. W.
50 ft.	40 ft. 0 in.	9 ft. 1 in.	5 ft. 0 in.	9 ft. 6 in.
55 ft.	44 ft. 0 in.	8 ft. 11 in.	5 ft. 6 in.	9 ft. 4 in.
60 ft.	48 ft. 0 in.	8 ft. 8 in.	6 ft. 0 in.	9 ft. 3 in.
65 ft.	52 ft. 0 in.	8 ft. 6 in.	6 ft. 6 in.	9 ft. 2 in.
70 ft.	56 ft. 0 in.	8 ft. 3 in.	7 ft. 0 in.	9 ft. 0 in.
75 ft.	60 ft. 0 in.	8 ft. 0 in.	7 ft. 6 in.	8 ft. 10 in.
80 ft.	64 ft. 0 in.	7 ft. 8 in.	8 ft. 0 in.	8 ft. 8 in.
85 ft.	68 ft. 0 in.	7 ft. 5 in.	8 ft. 6 in.	8 ft. 6 in.
90 ft.	72 ft. 0 in.	7 ft. 2 in.	9 ft. 0 in.	8 ft. 4 in.
95 ft.	76 ft. 0 in.	6 ft. 9 in.	9 ft. 6 in.	8 ft. 2 in.
100 ft.	80 ft. 0 in.	6 ft. 5 in.	10 ft. 0 in.	8 ft. 0 in.
105 ft.	84 ft. 0 in.	6 ft. 1 in.	10 ft. 6 in.	7 ft. 9 in.
110 ft.	88 ft. 0 in.	5 ft. 8 in.	11 ft. 0 in.	7 ft. 7 in.
115 ft.	92 ft. 0 in.	5 ft. 3 in.	11 ft. 6 in.	7 ft. 4 in.
120 ft.	96 ft. 0 in.	4 ft. 10 in.	12 ft. 0 in.	7 ft. 1 in.

Rule 30.—In seventh line, after the word "are" insert words "to be."

Page 19.—Table for maximum weight of loads has been revised by omitting the loads for cars of 50,000 lb. capacity and adding 140,000-lb. capacity cars 44 ft. and 46 ft. long. The addition to the table is as follows:

Length of Car.	Length of Material.	Capacity of Car. 100,000 lb.	Capacity of Car. 140,000 lb.
	44 ft.	98,000 lb.	138,000 lb.
	46 ft.	93,000 lb.	131,000 lb.
44 ft.	48 ft.	89,000 lb.	125,000 lb.
	50 ft.	85,000 lb.	119,000 lb.
	52 ft.	81,000 lb.	114,000 lb.
	46 ft.	99,000 lb.	139,000 lb.
	48 ft.	94,000 lb.	132,000 lb.
46 ft.	50 ft.	90,000 lb.	126,000 lb.
	52 ft.	86,000 lb.	121,000 lb.
	54 ft.	82,000 lb.	116,000 lb.

NOTE.—For loads of uniform width throughout length of load the *minimum* width (W) for Distances Between Bearing Pieces (D) and Length of Overhang (C) applies.

Fig. 7.—Omit note reading as follows: "For logs, piling, props and telegraph poles, use 10 strands or 5 wrappings, Rule 57." Also omit reference to Rule 59.

Fig. 9.—Eliminate the brake shaft on idler underneath overhanging portion of load.

Rule 59.—Omit reference to Fig. 7.

Figs. 22, 23 and 24.—Eliminate from cuts temporary ladders

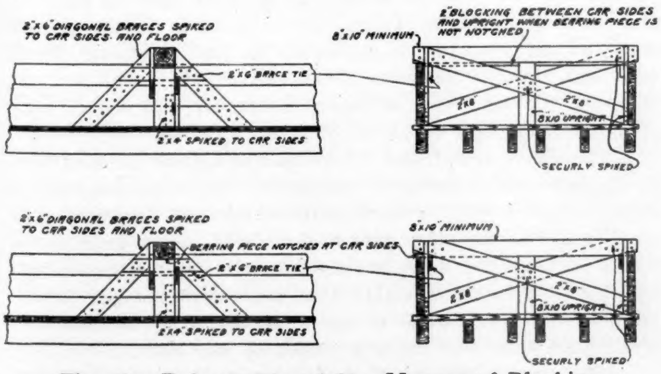


Fig. 42.—Rules 7, 80 and 81. Manner of Blocking Rectangular Bearing Pieces

and handholds, also omit reference to the ladders and handholds in Rules 60 and 66A.

Rule 72.—Change the word "or" to "on" in the first line. "On" is intended.

Fig. 35.—Omit. This cut is taken care of in revised end view of Fig. 34.

Figs. 34, 41 and 42.—Cuts revised to show a more modern car and the bracing of temporary bolster changed to conform to modern practice.

Rule 82.—Add a sentence to first paragraph reading as follows: "Sliding piece may be placed on the sides or on the floor between the bolster and the end of the car used as an

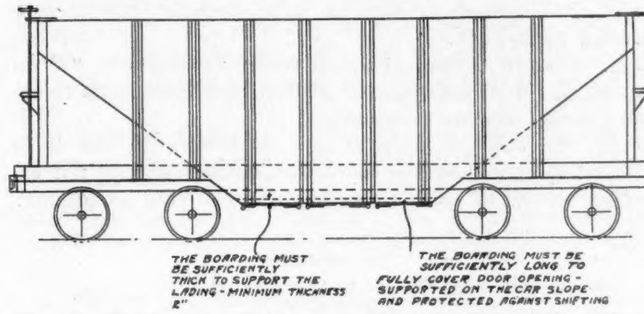


Fig. 62.—Rule 98-A. Diagram of Hopper Bottom Car Showing the Application of False Bottom for the Loading of Pig Iron Billets, Small Castings, etc.

idler, but in no case should the load carried between the bolster and the end of the car exceed fifteen (15) per cent of th capacity of the car having wood underframing, and

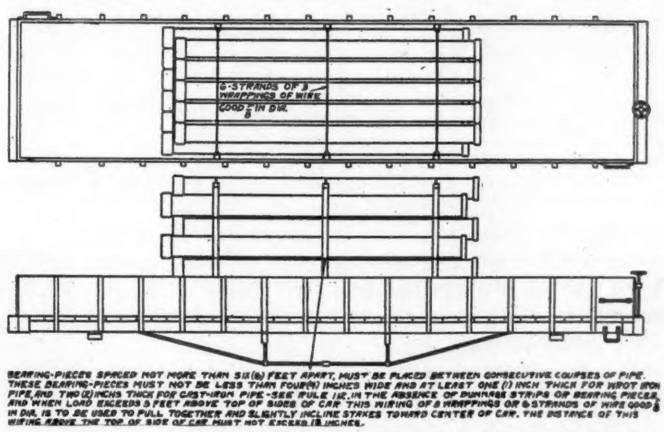


Fig. 74.—Rules 112, 112-A and 112-B. Loading in Gondola Cars One Length of All Pipe or Tubing 20 Ins. or Less in Diameter

twenty (20) per cent of the capacity of the car having steel underframing."

Second paragraph, after the words "weight" in the second line insert "on the post or posts is."

Rule 85.—Make note a part of the rule.

Fig. 54.—Revise cut showing diagonal braces spiked to

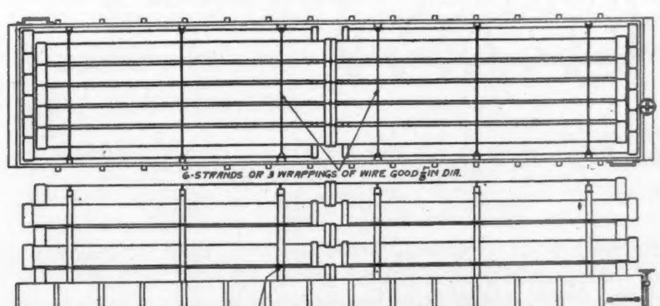


Fig. 76.—Rules 112 and 112-A. Loading in Gondola Cars Two Lengths of All Pipe or Tubing 20 In. or Less in Diameter x 23 Ft. or Less in Length

center post and bearing piece, instead of being secured by ¾-in. bolts.

Rule 92.—Omit reference in the rule to Figs. 53, 55, 56, and cut on page 86, also omit cuts in reprinting the code of loading rules.

Explanation: Cars having sides too weak to carry the lading without additional supports should not be used for such load.

Fig. 62.—Revised to show a more modern type of self-cleaning hopper car.

Fig. 63.—Add to this cut a note reading as follows: "When loading on top of the sides of gondola cars these bolts to extend through bearing piece, only."

Page 98.—List of Material, add a column to the table covering girders weighing more than 115,000 lb. and not exceeding 200,000 lb. The new column would read as follows:

For Girders weighing more than 115,000 lb., and not exceeding 200,000 lb.
14 in. x 20 in. or its equivalent in steel
*8 in. x 12 ft.
4 in. x 12 in. x 5 ft.
4 in. x 10 in. x 5 ft.
4 in. x 10 in. x 2 ft.
6 in. x ½ in. x 4 ft.
6 ft. x ⅝ in. x 2 ft. 1 in.
12 in. x ⅝ in. x 12 in.
12 in. x ⅜ in. x 12 in.
2½ in. diam.
5 in. x ⅜ in x 1 ft. 6 in.
3½ in. x 5 in. x ⅜ in. x 18 in. long
6 in. x 1⅛ in. x 1 ft. 4 in.
1½ in. rod or 3 in. x ¾ in. flat
¾ in. diam.
⅞ in. diam.
⅞ in. diam.
⅞ in. diam.
1 in. diam.
6 in. channels or angle 4 ft. 10 in. long.

Rule 104. Page 105.—Add a sentence to the beginning of paragraph E reading as follows: "Center plate backing should have transverse bolts not less than ⅝ in. in diameter one on each side of center pin, to prevent the splitting of center plate backing."

Fig. 80.—Show end blocking 4 in. by 5 in. at ends of pipe near the ends of car to make the cut conform to Rule 115-A.

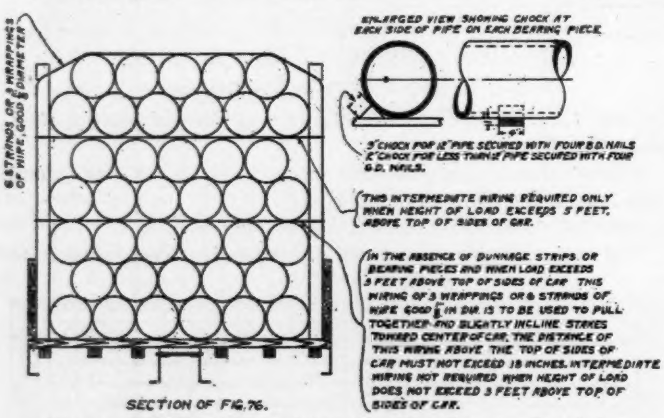


Fig. 77.—Rules 112 and 112-A. Loading in Gondola Cars of All Pipe or Tubing 20 Ins. or Less in Diameter x 23 Ft. or Less in Length

Revise the index showing brick and mill cinder or slag made in cakes, under Rule 118-A

Figs. 74, 76 and 77.—Revised to show more modern practices of securing pipe on gondola cars.

Rule 119.—Omit third paragraph.

Explanation: Stone loaded on top of a single stone or tier of stone, when the bearing surface of the top stone is one-half greater than the stone underneath, is an undesirable load.

Figs. 103 and 104.—Add to note after the word "boards" "1 in. by 6 in." and after the word "thick" the words "at center" to make the note conform to Rule 124.

Rules 132 and 132-A.—In the second line after the word "governing" omit the word "official" in order to make the rule more general. The Official Classification is effective only on the Eastern railroads.

DISCUSSION

Mr. Kearney: Since the printing of this report the committee has had its attention directed to three questions, to which I would like to refer. The first is the loading of long stringers or girders on the bearing pieces carried inside gondola cars some distance from the floor, where smaller material is loaded under the bearing pieces. The second refers to temporary ends for pipe loads above the sides of gondola cars. The third is a question the committee has had in its hands for some time and has passed upon, but my attention has been directed to it since reaching here, and for that reason I want again to refer to it. In our rules we specify that the idler must be equal to the carrying capacity of the loaded car. We were asked if we could not modify that and provide for a car of a capacity less than that of the loaded car. We thought it was inadvisable to change our rules and still think so. As a compromise it was suggested that we limit the idler to 80,000 lb. capacity, so as to allow an 80,000 lb. capacity flat car to be used with two 100,000 lb. flat cars, the two end cars carrying the load; but even that we think is inadvisable because the flat car at best is at a disadvantage, especially when not carrying the load.

With reference to the first two items, I would ask, Mr. President, that we be allowed to continue them under consideration, to get the opinion of the committee, and if they wish to present them with the balance of the report for letter ballot, that we be allowed to do so.

Mr. Brazier: I have been in correspondence with the committee through the secretary. Our rule 10 reads: "If the idler is a flat car of wooden construction its capacity must not be less than the carrying cars." It seems to me if we had a load on two 100,000-lb. capacity cars and had an overhang, we should have a car of similar capacity next to it. I made the suggestion that the item should read: "If the idler is a flat car of wooden construction its capacity and strength must be sufficient for the service it is to perform," and leave it with the connecting lines. Under the present rules the inspectors hold up the shipments. If they happen to see a wooden car used as an idler which is of less capacity than the carrying cars, we have to go and get another car of similar capacity.

Mr. Kearney: I feel that the capacity of the idler should not be less than the carrying car, where we refer to the wooden construction. It is true the first and third car carry the load or in an overhang, to which Mr. Brazier refers, the car carrying the load must necessarily be of the proper capacity, and the other is simply an idler or spacing car. At the same time, the empty car is subjected to all the shocks that the carrying car is subjected to, and it should be of sufficient capacity to stand those end shocks. The flat car carrying the load is a stronger car under end shock than the empty car can be ahead of it.

F. F. Gaines, (C. of Ga.): I would like to ask Mr. Kearney, in support of Mr. Brazier's contention, if it is not possible to have idlers of light constructions which will be equally as good or bad as the other cars in the train? What good would it do to have the extra strength in the idler between the two cars? It is very certain that there will be cars in the train of strength similar to the idler, and I cannot see why we should have this extra strength in the idler.

I think, in submitting this question to letter ballot, that the alternative should be given to the members in voting on the proposition, whether the cars should be of equal capacity, say 80,000 lb. capacity, or leave it to the judgment of the receiving road.

Samuel Lynn, (P. & L. E.): The question at issue is an empty flat car, which is to accompany a load of steel or overhanging load. The idler car is trussed up with a 100,000 lb. capacity steel car, probably next to the engine, and with the starting and stopping of the train, you do not get very far until the flat car is broken in two in the middle, if it is a 50,000 lb. or 60,000 lb. capacity car and the sills are rotten. We should not demand a 100,000 lb. flat car, but I do not

think that we should go below 80,000 lb. capacity in the idler. In the Pittsburgh district we have had that experience, and if you leave it up to the transportation department or the delivering company to furnish the idler, they will put in any old car when business is like it is at the present time and cars are scarce.

Mr. Hennessey: There is danger of having a weak flat car in between two strong cars, but there is no more danger of this car being weak, in fact there is not as much danger as in the case of the other cars in the train, because before there can be much compression put on the center car, they have got to move the loads on the two cars in front of and behind the center or idler car; that takes up part of the shock. You have no more danger with a weak idler to take care of the overhang between the two loaded cars than you have in the case of a weak car in any other part of the train. The matter should be left to the receiving lines to determine whether the idler is of sufficient strength or not.

Mr. Lynn: We will not permit a loaded wooden car in the front end of a train, but we require the idler car to be put in the train wherever the transportation people can put it; that is why we want to have it of sufficient strength to stand up under the shocks it will receive. But by modifying that rule so that you do not require a 100,000-lb. capacity car as an idler, you will ease up the conditions and get the shipments through more quickly.

The President: It does not seem that it is necessary to have a car of the full capacity of the carrying cars; Mr. Lynn's suggestion is a good one, and I would like to have him put that in the form of a motion.

Mr. Lynn: I will make a motion that the second paragraph of rule 10 be modified so as to limit the use of a wooden flat car to 80,000-lb. capacity with the higher capacity cars under load.

R. L. Kleine, (Penna. R. R.): In the triple loading you select the two carrying cars, and then put in as the idler a weak car. Some of the roads will put in anything as an idler with the two other cars to make up the length for the load. The motion as made by Mr. Lynn will cover the situation.

A. E. Herrold, (Monongahela Connecting Line): In case you have an overhanging load on two 60,000-lb. capacity cars, or only one 60,000-lb. capacity car, would it be necessary to use an 80,000-lb. capacity idler in connection with that load?

The President: That is what I was trying to have Mr. Lynn bring out, about how much below the carrying capacity of the loaded cars we could have in the idler.

Mr. Lynn: If the loaded cars were of 80,000-lb. capacity and the idler was a wooden car, it should be of 80,000-lb. capacity.

(Mr. Lynn's motion was carried.)

Report of Committee on Car Construction

The Committee on Car Construction has acted wisely in deferring action on the Master Car Builders' standard box car in view of the work being done by the subcommittee of the American Railway Association. As stated in the report, the M. C. B. committee has co-operated with the committee of the American Railway Association, which has in hand the design of a standard box car, and there can be no doubt that to work in this way was better than to go ahead independently, under which conditions two designs for cars would probably be evolved and would later have to be harmonized if a standard car is to be adopted. The committee also presented a short supplementary report.

W. F. Keisel, Jr., Chairman

The chairman of this committee, W. F. Kiesel, Jr., assistant mechanical engineer, Pennsylvania Railroad, is particularly well suited to have charge of this work. His work in connection with both locomotive and car design for many years is well known. The other members of the committee are: A. R. Ayers, principal assistant engineer, New York Central; H. T. Bentley, superintendent of motive power, Chicago & North Western; C. E. Fuller, superintendent of motive power, Union Pacific; E. G. Chenoweth, mechanical engineer, Chicago, Rock Island & Pacific; J. C. Fritts, master car builder, Delaware, Lackawanna & Western; C. L. Meister, mechanical engineer, Atlantic Coast Line.

THE indications show a desire on the part of the railroads to await the results of the development of the box car design which was under way by the subcommittee of the American Railway Association. As members of the committee were also acting in an advistory capacity with the subcommittee of the American Railway Association, it was deemed advisable to do nothing for the present in the development of the Master Car Builders' design of box car, but to assist, as far as possible, in perfecting the American Railway Association box car design in line with the work already accomplished on the proposed M. C. B. box car.

The proper distance between center sills of steel cars is one that will require serious consideration, as this Association should adopt either the present spacing generally in use, which is 12⅞ in., or determine on some other spacing that can be considered fixed for a number of years. The spacing of 12⅞ in. permits a car 40 ft. long to pass around a curve having 50 ft. radius without interference between the wheel flanges and center sill flanges. It will readily be seen that if the distance between center sills is increased, or if the distance between centers of trucks is increased, the radius of curvature around which car will pass will have to be greater. The distance between center sills affects the work of the Coupler Committee and Draft Gear Committee, in addition to that of the Committee on Car Construction.

The committee recommends that the present spacing of 12⅞ in. be adopted as Recommended Practice, and that draft gear and couplers be made for this spacing of center sills.

The following supplemental report was presented:

Your committee has had referred to it a communication with diagram from F. O. Walsh, superintendent of motive power and equipment, Georgia Railroad, setting forth action taken by the General Managers' Association of the Southeast, asking for the adoption of rules by the M. C. B. Association, providing for the application and maintenance of an inside fastening for end doors, and also for the adoption of additional side door guides with 2½ in. to 3 in. depth of lip.

The recommendations concerning inside fastening for end doors is taken care of by the existing recommended practice of the M. C. B. Association. The fastening recommended by the General Managers' Association of the Southeast does not comply with the M. C. B. recommended practice, as it is not automatic.

The application of bottom door guides shown on M. C. B.

sheet 30 is standard for new cars and appears to afford better support for the door in all positions than the arrangement recommended by the General Managers' Association of the Southeast. The height of the M. C. B. lip appears sufficient for any car in serviceable condition. Many old cars, however, are running with only one or two bottom guides with short lips. In its 1914 report this committee recommended a specification for reinforcing existing car doors. As these recommendations covered vital defects in a large number of existing box car side doors, which make them very insecure, and as the changes specified are simple and inexpensive, the committee urges that the association take action toward the improvement of these conditions by adopting the recommendations previously made.

(Both the original and supplemental reports of the committee were submitted to letter ballot.)

Report of Committee on Car Trucks

To a considerable extent the same reasons apply for the omission this year, on the part of the Committee on Car Trucks, of any extended report, as in the case of the Committee on Car Construction. Considering the work that is being done by the subcommittee of the American Railway Association on the design of a standard box car, the action of the M. C. B. committee on car trucks has prevented a possible duplication of the work and has simplified the problem of adopting a standard box car if it is later decided to do this. The report calls special attention to the design of the brake hanger and its fastening to the truck, which the committee recommends be held over until next year. A similar recommendation was made in the report of the Committee on Brake Shoe and Brake Beam Equipment.

J. T. Wallis, Chairman

The chairman of the committee is J. T. Wallis, general superintendent of motive power, Pennsylvania Railroad. The other members are: E. W. Pratt, assistant superintendent of motive power, Chicago & North Western; James Coleman, superintendent car department, Grand Trunk; J. J. Tatum, superintendent freight car department, Baltimore & Ohio; Prof. E. C. Schmidt, University of Illinois; L. C. Ord, Canadian Pacific; J. McMullen, mechanical superintendent, Erie; A. A. Ayers, principal assistant engineer, New York Central; E. G. Chenoweth, mechanical engineer, Chicago, Rock Island & Pacific.

ON account of the American Railway Association Committee on Design of Standard Box Car having under consideration some minor changes in the design of truck bolsters involving probable slight changes in the limiting dimensions of cast-steel truck sides, the committee deems it advisable to await the final conclusions of that committee before recommending any changes in the present Recommended Practices.

The Committee on Brake Shoe and Brake Beam Equipment submitted to the Car Truck Committee a proposed design of brake-beam hanger and manner of fastening to truck which received the approval of the Car Truck Committee, inasmuch as the hanger conformed in length and location to the limiting dimensions for cast-steel truck sides, now a Recommended Practice of the Association. Subsequent to this, criticisms have been made of the manner of securing the brake-beam hanger to the truck and of the design of the hanger, involving changes in the hanger where it enters the brake head and modifications of the hanger hole in the brake head. The committee, therefore, recommends that the design of brake hanger and its fastening to the truck be held over until next year, when the question of truck design for standard box car will be settled by the American Railway Association Standard Box Car Committee.

(The report and the recommendations of the committee were accepted.)

Report on Train Lighting and Equipment

This committee early recognized that on account of the extensive growth in axle light devices, the recent appearance of lightweight body suspended generators differing radically from earlier forms arranged for truck suspension, improvements in details of car lighting accessories, etc., a revision of previous recommended practices should be made. The committee also recognized that a re-wording and re-grouping of the various features covered in previous reports was desirable. One of the most important features of the report this year is that of clearances for the axle generator equipment so that car designers and builders can have exact information as to the clearances necessary for proper installation and operation, especially as regards the belt. By taking belt clearances into consideration in the design of trucks much can be accomplished in reducing belt failures in future operation, for lack of proper belt clearance is one of the chief causes of belt failures.

J. H. Davis, Chairman

The committee consists of J. H. Davis, chairman, electrical engineer, Baltimore & Ohio; C. H. Quinn, chief electrical engineer, Norfolk & Western; D. J. Cartwright, electrical engineer, Lehigh Valley; E. W. Jansen, electrical engineer, Illinois Central; H. C. Meloy, electrical engineer, New York Central; J. R. Sloane, engineer of electric car lighting, Pennsylvania; E. Wanamaker, electrical engineer, Chicago, Rock Island & Pacific.

THE rapid growth in recent years of axle-light devices for car lighting, the recent appearance of light-weight "body suspended" car-lighting generators differing radically from the earlier forms arranged for truck suspension, improvements in details of car-lighting accessories, rendering certain parts heretofore accepted as Recommended Practice

obsolete, and the improvement in the art of incandescent-lamp manufacture and reduction in lamp cost, make available an additional unit for car-lighting work, etc.; in consideration of these facts it appeared advisable to the committee to review the work of the Train Lighting and Equipment Committee since its inception, and as a result the committee suggests a revision of certain Recommended Practices, as follows:

Change the present paragraphs 23, 27 and 28 to the following:

3. Clearances.—(a) The axle-generator suspension shall be so designed that with car on level track the clearances

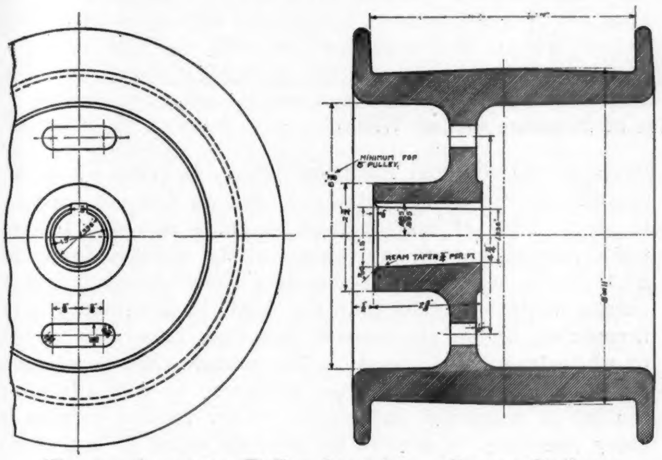


Fig. 1.—Armature Pulley for 8 in. or Larger Pulleys for Sleeve Bearing Generator

shall be as great as possible but not less than those specified below:

(b) From any part of the generator or suspension to the rail ....6 in.

(c) On truck-suspended generators from any part of the generator or suspension to the car body or any part attached thereto ....3½ in.

(d) With all parts of the car and axle generator, affecting

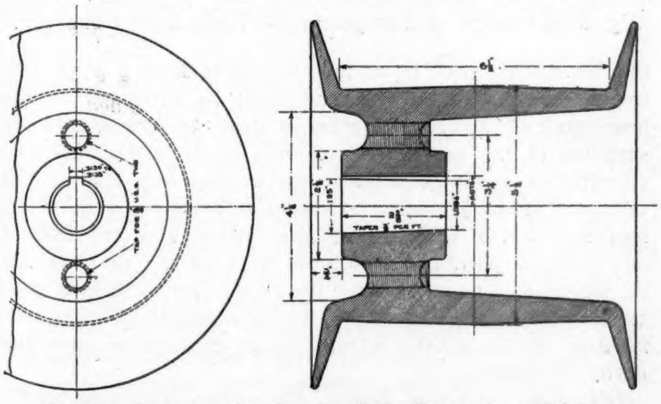


Fig. 2.—Armature Pulley for Axle Generators Having Armature Shafts Less than 1½ in. in Diameter

the clearances, in the same condition as when new, with the minimum belt tension to drive load and with the generator in any service position with respect to the suspension and with the truck in any service position with respect to the car body, the clearance from any part of the belt to

	End Sill.		Brk. Beam.		To any other part car
	Over.	Under.	Over.	Under.	body or truck.
Trk. Sprtd...	1 in.	1½ in.	2½ in.	1 in.	½ in.
Body " ...	1½ in.	1½ in.	3 in.	1 in.	1 in.

(e) With any or all parts of car and axle generator worn to the allowable limits and other conditions the same as in paragraph (d), from the belt to any part of the truck or car body ....½ in.

Change paragraphs 25 and 26 to the following:

4. Generator.—Suspensions.—(a) In axle-generator suspensions, all supporting parts subject to wear shall have the wearing surfaces bushed.

(b) All axle generators shall be provided with safety chains or an equivalent construction which will safely support the generator in case of failure of the suspension.

(c) In truck-supported axle generator suspensions, if side arms be used, the end to be secured to the truck frame shall extend under the transom and be secured to the side frame near the transom and shall be securely attached to the end sill by a U bolt not less than ¾ in. in diameter, or a construction equivalent in strength.

Add: *7. Generator.—Armature Pulley.*—(c) On all sleeve bearing axle-generators having armature pulleys 8 in. in diameter or larger, the armature pulley shall be in accordance with the dimensions as shown in Fig 1.

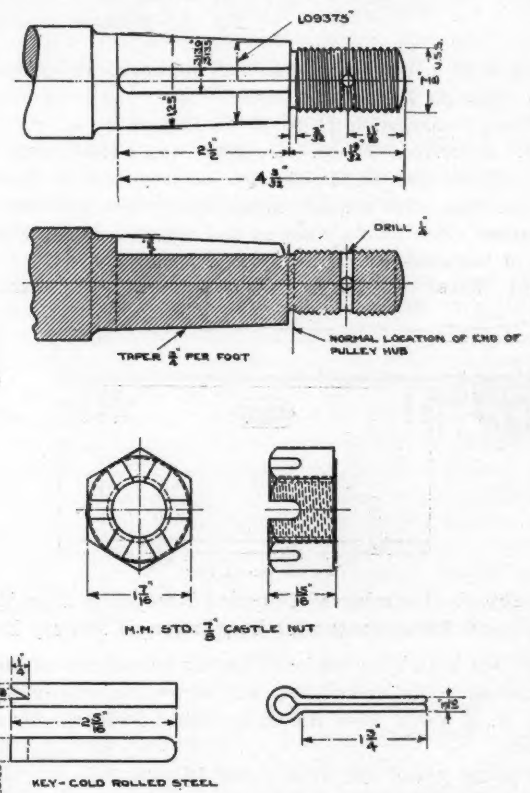


Fig. 3.—Nut, Key and Cotter Pin for Pulley Shown in Fig. 2

(d) On all axle generators having armature shafts less than 1½ in. in diameter at inner end of pulley seat, the armature pulley shall be in accordance with dimensions shown in Fig. 2.

Add: *8. Generator.—Armature Pulley Seat.*—(c) On all axle generators having armature shafts less than 1½ in.

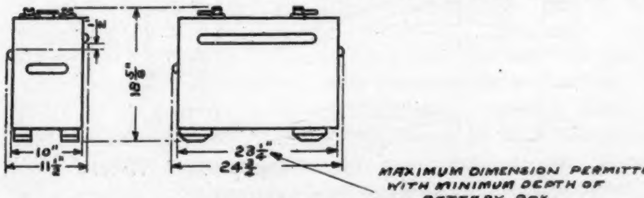


Fig. 4.—Maximum Dimensions of Batteries Assembled in Trays

diameter at end of pulley seat, the pulley end of armature shaft, the nut, key and cotter pin shall be in accordance with the dimensions shown in Fig 3.

Change paragraph 17 to 11 as follows:

11. Batteries.—Boxes, Ventilation of.—(a) Each battery box shall be provided with adequate ventilation as follows:

(b) Inlet openings located on the longitudinal center line of the floor of the battery box having a combined area of

approximately six sq. in. for each 22⅝-in. compartment.

(c) Outlet openings located near the top of the battery box having a combined area of approximately six sq. in. for each 22⅝-in. compartment.

Change paragraph 15 to 12 as follows:

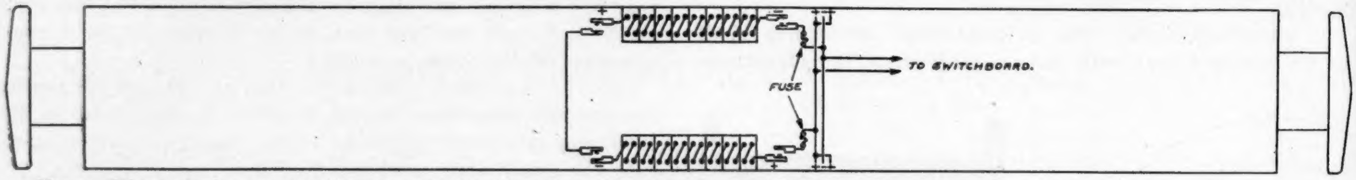
12. Batteries.—Trays, Dimensions of.—Storage batteries for car lighting service shall be assembled in trays whose maximum dimensions shall not exceed those given in Fig. 4

18. Wiring.—Generator Leads.—The electrical connections between the axle generator and permanent wiring on the car shall be made in such a manner that the leads can not be transposed.

Change paragraphs 3 and 4 to 21 as follows:

21. Wiring.—Installation of Conduit and Wire.—The following rules shall be used for car wiring:

(a) *Conduit.*—All conduit shall conform to the require-



NOTE.—Where single set of battery is used for 30 volt system, all cells should be placed on same side of car.

Fig. 5.—Method of Connecting Set of Batteries to Car Wiring

when used in battery box having minimum dimensions given in paragraph 10 (a).

Change paragraph 11 to 15 as follows:

15. Batteries.—Fuses, for, Etc.—(a) That each electrically lighted car equipped with battery box or boxes shall be provided with suitable metal fuse boxes, said boxes to be mounted close to the positive and negative terminals of each set of batteries as shown in Fig. 5 and Fig. 6.

(b) These fuse boxes shall have mounted in them a block

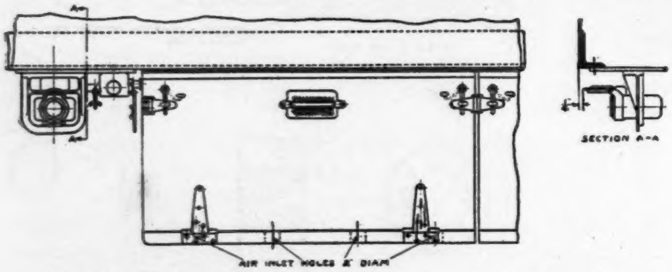


Fig. 6.—Location of Charging Receptacle Fuse Block and Arrangement for Ventilation of Battery Box

provided with fuse contacts having a capacity of 101 to 200 amperes. (The knife blade and screw contacts of the Standard N. E. Code were shown as being desirable for this purpose.)

Change paragraph 6 to 17 as follows:

17. Wiring.—Train Lines and Connectors.—(a) Cars operated in head-end system trains shall be equipped with three train line wires of No. 4/0 A. W. G.

(b) Cars not operated in head-end system trains may be equipped with two train line wires of No. 2 A. W. G.

(c) All cars equipped with train lines shall have the wires

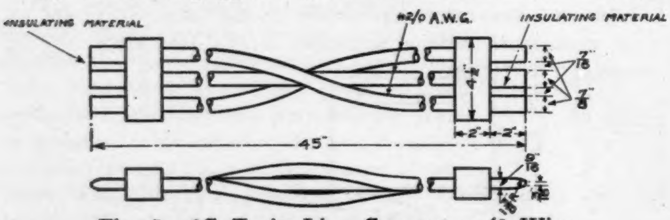


Fig. 7.—3G Train Line Connector (3 Wire for Head End System)

terminate in train line receptacles so designed that a standard train line connector such as shown in Fig. 7 and located as shown in Fig. 8 may be used.

(d) If only two wires are used they shall be connected to the outside terminals and the train line receptacle on each end of the car shall be stencilled: "NOT FOR USE ON HEAD-END SYSTEM."

(e) Where train line wires are used they shall be transposed as shown in Fig. 9.

Change paragraph 22 to 18 as follows:

ments of the National Electrical Code. It shall, wherever possible, be run on the interior of the car but not exposed to view. Ends of conduit shall be cut square and the interior reamed smooth, the contour of the material from the inner to the outer wall at the ends being approximately a quarter circle. Conduits shall not "butt" in couplings. Where threads on conduit are exposed they shall preferably be red or white leaded and painted. The conduit shall be of such a size and so arranged that the wires may be pulled in after the car is completed and pulled out for repairs without it being necessary to remove the interior finish of car. Conduit less than ⅝ in. shall not be used. Conduit and fittings shall be firmly and securely attached to the car body. The

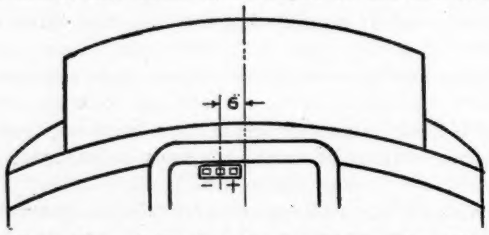


Fig. 8.—Location of Receptacle for Train Line Connector

conduit system shall be so installed as to form a good, contінous electrical conductor and shall be grounded to the framework of the car. On steel or steel-underframe cars the supports of the conduit system will be considered as constituting an adequate ground. On wooden cars the conduit system shall be grounded by means of a copper wire of not less than No. 6 A. W. G. securely attached to the conduit and to some portion of the steel work of the car that has an electrical connection with the rail, so as to form a good electrical connection at the points of attachment. The connections of the ground wire shall be exposed to view and easily accessible.

(b) *Fuse, Junction Boxes, Etc.*—Fuse, Junction, outlet, connection and pull boxes exposed to the weather shall be of cast iron. The wall thickness at the bosses for the con-

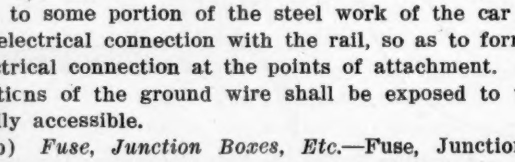


Fig. 9.—Method of Transposing Train Line Wires (3 Wires)

duit shall be such as to ensure at least five threads of the conduit are engaged and that the interior of the boss be rounded off so as to provide the equivalent of an outlet bushing. "Knock-out" boxes or pressed or formed steel boxes may be used when not exposed to the weather, and, when used, locknuts shall be used on the conduit on both sides of the box wall and an outlet bushing on the end of the

conduit. Pull boxes shall be installed where, on account of the length of run or number of bends, it would otherwise be difficult to pull in the wires. Fuse boxes for the main battery fuses shall be installed as close to the terminals of the battery, both positive and negative, as possible. All boxes shall be so installed as to render the covers of same readily accessible. The covers of boxes exposed to the weather shall be applied in such a manner as to render the box "weatherproof."

(c) *Wire.*—All wires shall be insulated with Grade "A" (30 per cent Para rubber) insulation if mineral base compound be used according to the specification of the Association of Railway Electrical Engineers, or equivalent, and shall be double braided, or if a wax base compound be used it shall be of a corresponding quality. No wire smaller than No. 14 A. W. G. shall be used, except for fixture work where No. 18 A. W. G. is permissible. All wires shall be run in metal conduit. No wire shall carry, under normal operating conditions, a current in excess of the values permitted by the National Electric Code for the size of wire in question. Train line wires on cars intended for service on head-end system shall be No. 4/0 A. W. G. Train line wires on cars not intended for service on head-end system shall be No. 2 A. W. G. All wires of No. 8 or larger shall be stranded. Train line connection between car, shall be as follows:

Head-End System.—No. 2/0 A. W. G., 833 strands or more, 5-64 in. insulation and one braid.

Not for Head-End System.—No. 2 A. W. G., 133 strands or more, 4-64 in. insulation and one weatherproof braid. The leads from the generator to the terminal connector on the car body shall be as follows:

Armature Leads.—No. 4 A. W. G., 61 strands, 4-64 in. insulation, one weatherproof braid.

Field Leads.—No. 8 A. W. G., 19 strands, 3-64 in. insulation, two weatherproof braids.

Joints and Splices.—The insulation shall be removed from the wire in such a manner that the wire shall not be cut, scored or nicked. All joints and splices shall be so made as to be both mechanically and electrically secure without the use of solder. All joints and splices shall be soldered, the soldering flux shall be free from acid. All wires joined or spliced shall be installed in such a manner that the joint or splices come in a junction box or fitting. Slack shall be left in wires at junction boxes and other outlets. Care should be taken that no sharp end of wire or solder is left to pierce the insulation and cause a ground. The joint or splice shall be covered with a rubber tape to the thickness of the original insulation, and this covered with friction tape to the overall diameter of the complete insulated wire.

[NOTE.—The entire Recommended Practices under "Train Lighting" were revised and regrouped, but only the more important changes are considered here.—EDITOR.]

Rule 12-C of Code of Rules Governing the Condition of and Repairs to Passenger Cars in Interchange was drafted several years ago and it was then felt that electrically lighted cars were of superior class and therefore a charge of 75 cents per day was justifiable to cover the use of the electrical equipment. The committee has given a thorough study to this matter, as a result of which it is recommended that this rule be eliminated and that Rule 12-E be changed to read as follows:

"On electric head-end lighting system of passenger-equipment trains the expense of an attendant, if furnished, shall be prorated among the roads in interest on a mileage basis."

It is further recommended that Rule 12-D be changed to read as follows:

"For repairs to electric-lighting equipment on cars in interchange, or leased cars, the instructions issued by the manufacturers of the apparatus should be strictly followed. In the absence of any agreement the material furnished and applied must be of the same manufacturer's make and quality as that which it replaces."

This change is suggested to make clear the intent of the rule.

The committee has given careful consideration to the matter of standardizing lugs on axle generators whereby standard makes and types would become interchangeable for standard forms of suspension. This question involves not only the location of lugs on the axle-generator frame, but also the question of truck, car and suspension design, and the number of variables in these items is so great that the committee believes a satisfactory solution of the problem is impossible.

On page 41, paragraph 21, Volume 49, Part 1, 1915 Proceedings of the M. C. B. Association, reads as follows: "A member suggests that the matter of electric train line jumper connections be considered as standard for passenger cars." This was referred to this committee by the Committee on Revision of Standards and Recommended Practice. The committee feels, on account of the proposed changes in "Recommended Practices" as embodied in this report, that it is not advisable at this time to make any recommendations concerning advancement to "Standards."

DISCUSSION

Mr. Davis, (chairman): I would like to say a word about the elimination of rule 12-C. The report shows very clearly why the committee feels that a charge of 75 cents a day should be eliminated, but since sending the report to the secretary it has come to our attention that there is a feeling existing that the present rental charge for cars as determined by the American Railway Association, which is determined on the seating capacity and class of car, is not sufficient, and until these charges prescribed by the association are adjusted somewhat upward, that this charge of 75 cents a day for use of electrical equipment on cars should be retained.

Of course, your Committee on this subject would have no suggestions to offer the American Railways Association as to what the equipment of cars should be, whether electric lights or gas lights, and it occurred to us that if it is desirable to make any charge for the use of electrical equipment, it might be as well to use the charge prescribed by the American Railway Association. But since electric lighting has now come into general use, and since we can now equip a car with the necessary devices and batteries with the standard thirty-volt system at practically one-half the cost we could five or six years ago when the committee first recommended this charge of 75 cents per day, and as the equipment is much more reliable in its performance, the chairman of the committee does not feel that any charge should be specifically made for the use of the electric lighting equipment on the car. It ought to be considered a car, and the rental value determined on the basis of seating capacity and class of car.

O. C. Wright, (Penn. Lines): I notice that the committee recommends to discontinue the 60-volt axle equipment. It seems to me that the committee has been a little bit hasty in making this recommendation. The reason given is that about only two per cent. of such cars are equipped with 60-volt axle system. While this may be true, and undoubtedly is, I think that some of that two per cent. is more than paying its way in better service rendered, and less maintenance cost.

Mr. Davis: I think the gentleman misunderstands the recommendation of the committee. It does not recommend that the 60-volt system be discontinued. What the committee does recommend is that the further use of the 60-volt system should no longer be recommended. As to the additional battery capacity desired with modern axle generators, if we provide clearances—I think we can decrease that; certainly we ought to be able to get 250,000 to 500,000 miles per failure, and we ought not to tie up too much money in the

battery. Instead of increasing the battery capacity, we feel it can be decreased.

G. W. Rink, (C. of N. J.): I see there are two styles of axles shown, it not being mentioned in regard to the finishing of that part of the axle between the wheel pits; our experience with an axle of that type, drop forged, has been very disastrous, due to the fact that we lost considerable pull through vibration, the center portion of the axle being slightly concentric. We have now gone to the straight axle fit, and that permits us to use one size fully sleeved. This comes in very handy, when you consider that you have to change the position. In the case of the four-wheel truck, we have the pulleys about 4 in. off center. I think, in view of standardization, we ought to try, if possible, to eliminate the M. C. B. axle and stick to the one sized axle, with a straight fit.

Mr. Davis: It occurs to me that the suggestion is a very good one, and I do not know at this moment why the committee did not specify that the straight axle should be rough turned.

E. W. Jansen, (I. C.): The tapered axle shows a straight taper. That naturally means rough turned. On the straight axle the exact diameter is given, and it was intended that it be rough turned.

J. R. Sloan, (Penna.): It is simply a matter that the committee overlooked. We all mean to have it rough turned. Mr. Cartwright, will you please restate your motion?

Mr. Cartwright: I move that the report of the Committee on Train Lighting and Equipment be received, in accordance with the recommendation of the committee, that the committee be continued.

(The motion was carried.)

ADDITIONAL EXHIBITS

Carbic Manufacturing Company, Duluth, Minn.—Carbic portable flare lights; Carbic oxy-acetylene welding and cutting generator and apparatus. Represented by D. C. Duncan and G. B. van Buren. Space 138.

Champion Rivet Company, Cleveland Ohio.—Boiler, ship and structural rivets; coupler, knuckle and air brake pins. Represented by W. S. Bateman, Geo. R. Boyce and Jos. R. Wetherald. Space 358.

Cox Automatic Coupler, Tampa, Fla.—Car coupler. Represented by W. R. Stafford. Space 309.

Ford & Company, J. B., Wyandotte, Mich.—Wyandotte cleaning specialties. Represented by W. P. Scott, T. C. Tompkins and W. E. Ratz. Space 631.

Happel Car Seal Company, Philadelphia, Pa.—Car seals. Represented by A. Hoch, J. P. Lodge and S. F. Happel. Space 153.

Keystone Lubricating Company, Philadelphia, Pa.—Samples of Keystone grease of different densities; gravity feed cup and automatic compression cups. Represented by A. C. Buzby, T. W. Armstrong and J. R. Menish. Space 543.

Locomotive Feed Water Heater Company, New York, N. Y.—Locomotive feed water heater. Represented by Geo. M. Basford, E. A. Averill and R. S. Brown. Space 412-414.

Locomotive Pulverized Fuel Company, New York, N. Y.—D. & H. locomotive 1200 on the exhibit track, Mississippi Ave. and Boardwalk, equipped with pulverized fuel burner. Represented by J. E. Muhlfeld and V. Z. Caracristi. Space 412-414.

McCabe Manufacturing Company, Lawrence, Mass.—Pneumatic flanging machine. Represented by F. H. McCabe. Space 388.

Mechanical Specialties Company, Boston, Mass.—Eagle claw wrench; La Rock wrench and Como pipe wrench. Represented by Geo. R. Law. Space 313.

Rumsey Car Door Company, New York, N. Y.—Model of steel and wood car door. Represented by H. M. Brittan and R. M. Moody. Space 325.

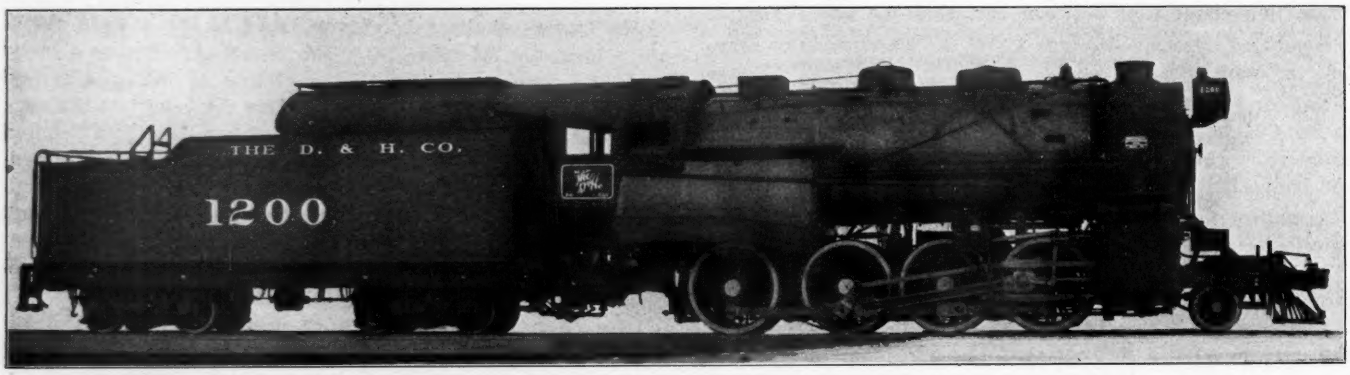
Virginia Equipment Company, Toledo, Ohio.—Three types of dust guards. compensating, compound and steel (self centering). Represented by Lacey Y. Williams. Space 331.

Williams, J. K., Jacksonville, Fla.—Lock brace for freight car doors. Represented by Laurence Williams. Space 307.

Worthington Pump & Machinery Corporation, New York, N. Y.—Latest type of Laidlaw feather valve compressor. Represented by Paul B. Fenlon. Space in front of Machinery Hall.

THE D. & H. PULVERIZED FUEL CONSOLIDATION

The pulverized fuel burning Consolidation type locomotive of the Delaware and Hudson has been brought to Atlantic City and is now under steam on the Reading tracks near the boardwalk. The engine will be under steam and using pulverized coal as fuel on the morning of Saturday, June 17, and the afternoon of Tuesday, June 20, so that visitors to the convention may have an opportunity to learn more about this system of combustion. While the locomotive was designed for the use of pulverized anthracite culm, it is intended to use pulverized bituminous coal at Atlantic City because most of those who will be in attendance at the convention are more familiar with bituminous than with anthracite coal.



The Delaware and Hudson Pulverized Fuel Locomotive

This locomotive was built specially for use with this form of fuel by the American Locomotive Company and is equipped with the apparatus of the Locomotive Pulverized Fuel Company, New York. It is the largest locomotive of its type ever built, and in many particulars ranks with locomotives of the Mikado type. It has 63-in. driving wheels, 27-in. by 32-in. cylinders, 12-in. piston valves and a boiler with a working pressure of 195 lb. The diameter of the boiler at the front end is 86 in. and a firebox 114 in. by 126 1-16 in. provides a grate area of 99.8 sq. ft. There are 326 2-in. tubes and 46 5⅜-in. flues, all 15 ft. long. The locomotive weighs, in working order, 293,000 lb., of which 267,000 lb. are on the drivers and 25,500 lb. on the truck. With a maximum tractive effort of 61,400 lb. the factor of adhesion is 4.35. The driving wheelbase is 17 ft. 6 in. and the total wheelbase 26 ft. 7 in. and the total wheelbase of engine and tender 65 ft. 5 in. The total evaporative heating surface is 3,814 sq. ft., of which 2,544 sq. ft. is in the tubes, 965 sq. ft. in the large flues, 251 sq. ft. in the firebox and 54 sq. ft. in the arch tubes. The superheater has 43 elements and a heating surface of 793 sq. ft. The tender is of the 8-wheel type with water capacity of 9,000 gal. and a fuel capacity of 14½ tons, and weighs in working order, 193,200 lb.

TRAIN SERVICE EMPLOYEES TO TAKE STRIKE VOTE

The conference between the National Conference Committee of Managers representing the railways of the United States and representatives of the Brotherhoods of Locomotive Engineers, Firemen, Conductors and Trainmen, which has been in progress in New York since June 1, broke up yesterday, and the officers of the brotherhoods have gone out to take a vote of their members on the question of a strike.

Before adjournment the Conference Committee of Managers proposed to the leaders of the brotherhoods that they arbitrate their differences under the Newland's Act or submit the questions involved to the Interstate Commerce Commission. The leaders of the brotherhoods refused to accept either proposal.

THE M. C. B. DANCE

The Master Car Builders' ball last night, on the Million Dollar Pier, was a most pronounced success. It was doubted by many of the old timers present if there ever had been a prettier ball in the history of this association.

The grand march was not commenced until about 10 o'clock; it was led by President and Mrs. MacBain. The dancing continued until the small hours this morning. There were two features of the evening; one was the formation of the large letters M. C. B. by the couples in the grand march. When the letters had been formed clear across the hall, the flashlight photograph was taken. The effect of the formation was enthusiastically applauded, as it was the first time the idea had ever been carried out. The other feature was the presentation to each lady of a silver vanity box.

The committee in charge was as follows: W. K. Krepps, general chairman of the Dance Committee; C. W. Floyd Coffin, chairman; R. E. Passmore, J. R. Forney, Don Clement, L. B. Sherman, C. C. Farmer and A. G. Bancroft.

LADIES' CARD PARTY

The M. C. B. Euchre Party was held yesterday afternoon at the Marlborough-Blenheim. It was a distinct success; 135 ladies came, and there were 24 prizes distributed, including many handsome pieces; refreshments were served following the game. The committee in charge was: Mrs. MacBain, chairman, assisted by Mrs. Fuller, Mrs. Goodnow, Mrs. Pratt, Mrs. Smith, Mrs. Spear and Mrs. Turner. The prizes were as follows: Mahogany clock, ivory desk lamp, after-dinner coffee pot, silver candlesticks, etched glass sandwich plates, set of luncheon napkins, set of linen doilies, silver steak knife and fork, silver vase, set of china plates, after-dinner coffee set, silver photograph frame, silver bonbon dish, silver bread tray, open vegetable dish, and silk handbag.

The winners were as follows, the first five having made perfect scores: Mrs. Springfellow, Mrs. C. A. Hardy, Mrs. W. R. Hulbert, Mrs. B. J. Miller, Mrs. B. E. Mallory, Mrs. Jean Clarke, Mrs. C. S. Branch, Mrs. W. H. Thorne, Miss Rena Mallory, Mrs. W. H. Miller, Mrs. W. H. Prentice, Mrs. E. R. Hibbard, Miss Olive M. Jones, Mrs. William Miller, Mrs. W. G. Wallace, Mrs. L. A. Williams, Mrs. W. A. Bennett, Mrs. F. O. Bunnell, Mrs. Strassburger, Mrs. A. L. Whipple, Mrs. F. W. Cohen, Mrs. E. H. Gold, Mrs. Frank A. Purdy and Mrs. E. W. Summers.

ADDITIONAL MASTER CAR BUILDERS' REGISTRATION

Andrewsetti, Jas. A., Ass't E. E.; C. & N. W.; Dennis.
Appler, A. B., Mech. Engr.; D. & H.; Blenheim.
Baldwin, T. C., M. M.; N. Y. C. & St. L.; Pennhurst.
Beaumont. H. A., G. F. C. S.; B. & O.; Alamac.
Bingham, Edmund D., Jr., Sp. Rep.; At. Sea. Desp.; Traymore.
Brogan, James, G. F.; D., L. & W.; Haddon Hall.
Brown, F. C., M. E.; Erie; De Ville.
Burgis, E. W., Gen. Supt.; N. O. S. & G. I.; Sterling.
Byron, A. W., M. M.; Penna. Lines; Blenheim.
Dobson, W. E., Gen. Aud.; Cambria & Ind.; Shelburne.
Garstang, Wm., Cons. S. M. P.; C. C. C. & St. L.; Blenheim.
Gernert, Henry. G. C. D.; Cent. N. J.; Chalfonte.
Gillette, E. S., E. E.; Aurora Elg. & Chgo.; Traymore.
Gould, J. E., M. M.; C. H. & N.; Dennis.
Hainen, J., G. S. M. P. & E.; So. Ry.; Dennis.
Jackson, O. S., G. S. M. P. & O.; C. T. H. & S. E.; Traymore.
Jaynes, R. T., M. M.; L. & H.; Traymore.
Kaderly, W. F., Genl. Supt.; G. S. & F.; Dennis.
Keagy, C. O., G. F.; Penna. R. R.; Traymore.
Kimmett. M. A., G. F. C. Dept.; Cent. N. J.; Elberon.
Lovell, Alfred, Cons. Engr.; Traymore.
McGary, Alex., S. C. L.; N. Y. C.
McGill, A. M., A. S. M. P.; L. V.; Brighton.
Martin, J. H., S. C. S.; Berwind White Coal Min. Co.
Mengel, Jno. C., M. M.; Penna. R. R.; Traymore.
Michael, J. B., M. M.; So. Ry.; Pennhurst.
Parks, O. J., Supt. Eq.; Ger.-Am. Car Co.; Traymore.
Quinn, C. H., A. E. M. P.; N. & W.; Dennis.
Ramage. J. C., Supt. Tests; So. Ry.; Craig Hall.
Rice, W. L., Supt. L. & C. S.; P. & R.; Monticello.
Robbins, F. B., A. G. F.; Penna.; Haddon Hall.
Robider, W. J.; M. C. B.; Ga. Cent.; Traymore.
Shull, G. F., M. M.; C. C. & O.; St. Charles.
Sheahan, J. F., S. M. P.; A. B. & A.; Chalfonte.
Smith, Benjamin T., G. F.; W. J. & S. S.
Smith, M. R., M. M.; C., I. & L.; Haddon Hall.
Small, J. W.. S. M. P.; S. A. L.; Chalfonte.
Totten, E. C., D. G. C. F.; N. Y. C.; Pennhurst.
Weight, G. C., G. C. I.; Penna. R. R.; Blenheim.

ADDITIONAL MASTER MECHANICS' REGISTRATION

Adams, A. C.; Gen. Brake Shoe & Sup. Co.; Dennis.
Appler, A. B., M. E.; D. & H.; Blenheim.
Barnum, M. K., S. M. P.; B. & O.; Dennis.
Burgis, E. W., G. S.; N. O. S. & G. I.; Sterling.
Butler, F. A., M. M.; B. & A.; Chalfonte.
Byron, A. W., M. M.; Penna.; Blenheim.
Dawson, L. L.. S. M. P.; Ft. W. & Den. City; Brighton.
Fagan, F. L., M. M.; Den. & Rio Gnd.; Chalfonte.
Fogg, J. W.; Boss Nut Co.; Chalfonte.
Gaines, F. F., S. M. P.; Cent. Ga.; Blenheim.
Garstang, Wm., Cons., S. M. P.; C. C. C. & St. L.; Blenheim.
Gilhausen, F. R., G. F.; B. & O; Shelburne.
Hainen, J., G. S. M. P. & E.; So. Ry.; Dennis.
Hanlin, J. J., M. M.; S. A. L.
Thomas, J. J., Jr., S. M. P.; So. Ry. Miss.; Chalfonte.
Tollerton, W. J., M. S.; C., R. I. & P.; Blenheim.
Tracy, W. L., A. S. M.; Mo. Pac.; Chalfonte.
Van Buskirk, H. C., Chalfonte.
Wahlen, Jno., M. M.; Mont. & Wells River; Arlington.
Waters, J. J., S. M. P.; Pere Marquette; Blenheim.
Wildin, G. W., M. S.; N. Y. N. H. & H.; Chalfonte.
Withrow, P. C., M. E.; D. & R. G.; Traymore.
Wright, R. V., Mgr. Editor, Ry. Age Gazette.

SPECIAL GUESTS

Adams, A. C., M. M.; S. A. L.; Dennis.
Ambrose, W. F., G. F.; B. & O.; Lexington.
Amos, J. A.; Wells Fargo & Co.; Chalfonte.
Andrews, S. B., Mech. Eng.; S. A. L.
Angier, F. J., Supt. Tim. Pres.; B. & O.; Lexington.
Baber, H. H., Ch. Cl. Pur. Agt.; Virginian; Arlington.
Battenhouse, Wm., G. F.; B. & O.; Lexington.
Baxter, Ernest, Pur. Agt.; St. L. & S. W.; Blenheim.
Bell, T. S., S. C. S.; P. R. R.
Bell, W. I., Supt. Signals; P. B. & W.; Traymore.
Bernheisel, T. W., A. S. C. S.; Berwind White Coal Min. Co.
Beverly, R. H., Asst. S. of T.; So. Ry.; Craig Hall.
Bixler, H. C., Supt. Sta. & Transfs.; Penna.
Borcea, Ed., M. E.; Roumanian Govt's Eng.; Shelburne.
Boyer, H. A., F. C. S.; Cent. of N. J.; Summerset.
Brentlinger, C. N., C. C. to S. M. P.; Penna. Lines; Shelburne.
Burns, N. F., S. I. C.; N. Y. C.; Dennis.
Butler, F. A., M. M.; B. & A.; Chalfonte.
Cage, C. A., G. F.; B. & O.
Carrow, G. C. S., G. F.; P. B. & W.; Belmont.
Carson, H. M., Genl. Supt.; P. R. R.
Clark, A. B.. Asst. Eng. M. W.; Penna.
Conghlin, W. G., Engr. M. W.; Penna.
Connor, J. T., Ass't Supt.; G. H. & S. A.; Chalfonte.
Cook, B., Ass't Eng. Tests; N. & W. Ry.
Cook, C. A., M. P.; P. B. & W.
Creighton, G. W., Gen. Supt.; P. R. R.
Cromwell, E. G., G. F.; B. & O.; Lexington.
Dow, T. W., G. A. B. Insp.; Erie; De Ville.
Drawbaugh, E. L., C. C. I.; Cum. Valley; Monticello.
Eisenhauer, Geo., Elec. Eng.; Hud. & Manhat.; St. Charles.
Fagan, J. F., M. M.; Den. & Rio Gd.; Chalfonte.

Fisher, J. B., Supt. Fr. Transp.; P. R. R.
French, E. L., G. F.; P. R. R.; Devonshire.
Galloway, G. R., Ass't M. M.; B. & O.; Lexington.
Geist, J. R., Sp. P. C. I.; B. & O.; Netherland.
Gelhausen, F. R., G. F.; B. & O.; Shelburne.
Gernert E., C. C. Car Dept.; Union Tank Line; Chalfonte.
Gest, A. P., Sec. Ass'n Transp. Officers; Penna. R. R.
Gleason, M. A., G. F.; B. & O.; Lexington.
Gonnerman, W. K., G. C. F.; B. & O.; Arlington.
Gumbes, J. H., Supt. Phila. Term. Div.; P. R. R.
Hanlin, J. J., M. M.; S. A. L.; Alamac.
Harley, G. B., Publicity Agent; P. R. R.
Hoff F. C., Ass't to Gen. Mgr.; P. R. R.
Hunt, E. B., Supt. Relief Dept.; Penna.
Hussey, F. A., R. F. E.; B. & A.; Chalfonte.
Johnson, J. C., Supt. Teleg.; P. R. R.
Jones, H. W., Ass't S. Insp.; P. R. R.; Elberon.
Jones, W. F., G. S. K.; N. Y. C.; Chalfonte.
Kane, J. R., G. F. C. & M.; B. & O.; Arlington.
Kelleher, W. J., Pur. Agt.; N. O. & N. W.; Traymore.
Kelley, R. F., Gen. Traf. Mgr.; W. & L. E.
Kern Wm., S. F.; B. & O.; Strand.
Kidd, C. M., Gen. A. B. I.; N. & W.; Brighton.
Kilborn, James E., Pur. Agt.; Rutland; Blenheim.
Kimmett, A. D., M. M.; Lacka. & W. V.; Elberon.
Koons, G. C., Ass't Engr. M. W.; Penna.
Krick, C. S., General Supt.; P. R. R.
Lammerding, F. A., Foreman; Penna.; Haddon Hall.
Lance, C. C., Shop Eng.; S. A. L.; Chalfonte.
Langton, C. E., Supt. Shops; S. A. L.; Dennis.
Latrobe, Gamble, Genl. Supt.; P. R. R.
Lee, Elisha, Ass't Gen. Mgr.; P. R. R.
Lehr, H. W., G. F. P. C. I.; Penna.; Haddon Hall.
Leiper, C. I., Supt.; N. Y., Phila. & Norf.
Lemke, E. R., Ass't R. F.; B. & O.; New Florence.
Long, S. C., Gen. Mgr.; P. R. R.
Lloyd, S. B., Solicitor; Penna.; Blenheim.
Lowther, H. F., Ass't P. A.; D. S. & N.; Dennis.
Lydon, L. S., At. Seab. Disp.; Alamac.
Lyons, T. F., A. B. I.; N. Y. C.; Shelburne.
McCabe, D. T., 3rd V. P.; Penna. Lines West; Dennis.
McKedy, H. V., Pur. Dept.; N. Y., N. H. & H.; Strand.
Mackey, W. C., P. C. F.; B. & O.; Chelsea.
Manns, F. F., Disbment. Cl.; Wab. Pgh. Ter.; Wellsboro.
Meagher, H. B., M. C. B. I.; B. & O.; Arlington.
Meckstroth, E. H., C. F.; B. & O.; Arlington.
Minard D. E., Solicitor; Erie; Blenheim.
Moses, E. P., Chf. Dftsn.; N. Y. C.; New England.
New, W. T., G. F.; So. Ry.; Traymore.
Norris, J. C., G. F. C.; C. V. R. R.; Chalfonte.
O'Donnel, R. L., Gen. Supt.; P. R. R.
Parker, H. H., M. M.; S. A. L.; Dennis.
Patton, C. S., M. M.; S. A. L.; Alamac.
Peck, W. F., M. P. I.; B. & O.
Pewlding. C. C., Solicitor; N. Y. C.; Blenheim.
Philpot J., Fmn. R. S. Dept.; N. Y. C.; Pennhurst.
Powell, James, Ch. Dftsn.; G. T. Ry.; Traymore.
Prendergast, J. F., Jr.; Traymore.
Prentice W. H., M. C. B. Cl.; P. C. C. & St. L.; Colwinn.
Reed, T. L., M. M.; S. A. L.; Alamac.
Rice, Robert M.; Monticello.
Robinson, Garland P., Ass't Ch. Insp.; I. C. C.; Haddon Hall.
Rodgers, J. G., Genl. Supt.; P. R. R.
Roney, John, Ass't Train Master; L. V.; Colonial.
Root, Jos. J., Jr., Mec. Eng.; Union Tank Line Co.; Traymore.
Rose, J. C., Claim Agent; Penna. R. R.
Rudd, A. H., Sig. Eng.; Penna.
Runkle, D. F., F. C. S.; At. City R. R.; Summerset.
Scott, G. E., P. Agt.; M. K. & T.; Blenheim.
Shaeffer, C. M., Gen. Supt. Trans.; P. R. R.
Shelton, F. M., Supt. Loco. Sup.; D., L. & W.; Haddon Hall.
Smith, A. J., En. Aurora & Chigo.
Smith. George Q., Sup. of Safety; Tol. & West.; Traymore.
Stewart, D. C., Supt. Pass. Transp.; P. R. R.
Stewart, H. A., Trav. Agt.; Rich., Fred. & Potomac, Chalfonte.
Stier, Wm., Ass't G. P. W. & I.; B. & O.
Stout, R. B., Mech. Expert; So. Pac.; Chalfonte.
Stratton, G. Edmund, I. P. E.; Penna. R. R.
Taurman, A., S. M. P. & R. S.; V. Ry. & Power Co.; Shelburne.
Tonge J. H., Supt.; Cumb. Valley.
Trazee, Wm., Pur. Dept.; P. R. R.
Trump, M., Sp. Ass't to G. M.; Penna.
Vaughn, Wm. H., Ass't M. M.; L. V.; Colonial.
Walker, Sylvester, C. C. M. C. B. C. H.; P. R. R.; Westminster.
Watson, J. W., M. M.; S. A. L.; Alamac.
Wible, T. E., G. P. W. I.; B. & O.; Lexington.
Williams, W. O., S. T. Dem.; So. Pac.; Chalfonte.

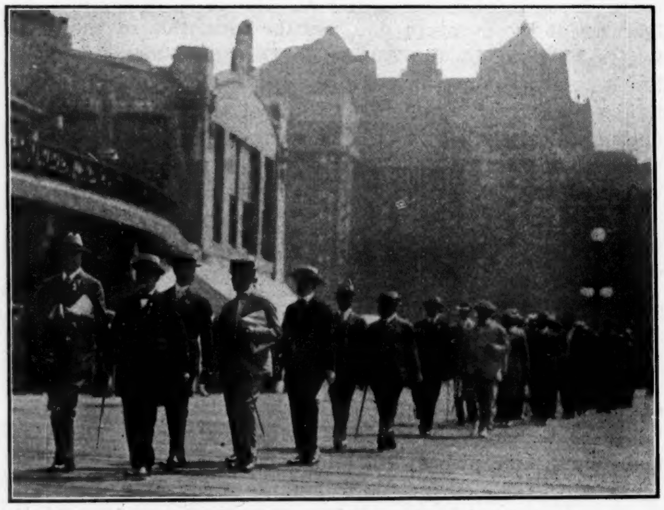
Conventionalities

John Cassada, foreman in the freight car yard of the Erie at Jersey City, died Wednesday morning of pneumonia. He had been ill only a few days.

President MacBain will have served, next October, 40 years continuously with roads that are now a part of the New York Central Lines. In all that time he has never missed a monthly salary check.

Henry P. Hoffstot, of the Pressed Steel Car sales department, is attending the Convention for the first time. He is around early and late trying to find out when the convention day starts and ends.

Stephen C. Mason was so unusually congenial on the occasion of his annual pilgrimage to the office of the *Daily* that we're not even going to mention the fact that he forgot to leave the usual box of cigars.



M. C. B. March, Wednesday Morning

J. C. Barber, former Master Car Builder of the Great Northern, and now President of the Standard Car Truck Co., is here. Mr. Barber is one of the old guard whose presence at these conventions means so much.

A. B. Appler, mechanical engineer of the Delaware and Hudson, arrived on Thursday morning. Mr. Appler has just returned from Berwick, Pa., where he has been inspecting the first all-steel passenger cars for his road.

William Gerard Phelps, purchasing agent of the Pennsylvania Lines West, is an enthusiastic golfer, but he puts duty before pleasure, and was in evidence among the exhibits on the Pier yesterday. H. O. Hukill will be here Friday.

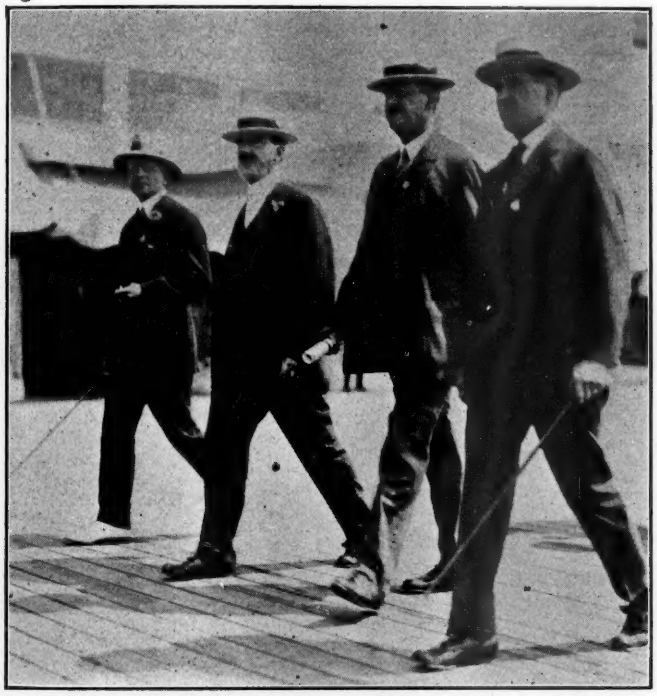
Ed. Baker, for many years with the Galena-Signal Oil Company, now a gentleman of leisure, is having the time of his life walking around among his old friends and failing to be recognized. Strange what the removal of an adornment of some 30 years' growth will do in the way of changing a man's face!

Sam Lynn, the genial master car builder of the Pittsburgh & Lake Erie, says that he has no bad feelings toward the *Daily* for misspelling his name in the report of the nominating committee which was published in Thursday morning's *Daily*. He has been nominated as a member of the executive committee.

S. L. Smith, vice-president, National Malleable Casting Company, has been ill with a very severe cold for several days and has been confined to his bed. While Mr. Smith's condition, it is said, is not serious, he will probably not be able to leave his home for a week or two.

It should be distinctly understood that Joe Taylor had nothing to do with the placing of the "silent zone" signs around the convention hall. Joe's efficiency diagrams are not working this year or it is presumed that the good effect of the signs would be immediately noticed on them.

Looking at F. H. Stark, mechanical superintendent of the Montour Railroad, one would never think that he had passed through a most serious and long illness during the latter part of the winter. He suffered from an attack of grippe, which finally made it necessary for him to go South and remain in Florida for a number of weeks. Apparently he has fully recovered his usual good health.



The Head of the M. C. B. March
Right to Left: Oscar F. Ostby, D. R. MacBain, E. W. Pratt and E. H. Walker

One of the workers on the board of trustees of the University of Illinois at Champaign is Robert F. Carr, of Chicago. Ever since his graduation at the university Mr. Carr has been an active Chicago alumnus and has taken great interest in the welfare of the institution. He is now attending commencement exercises at Champaign, but will be at Atlantic City before the close of the conventions.

The following memorandum, referring to the report of the R. S. M. A. nominating committee in Thursday morning's *Daily*, was found on the editor's desk and needs no explanation: "Edwin is a good name—so is Edgar, Edward and Edmond, but my humble front handle is Edmund. Perhaps the 'win' was put on as a hope of the R. A. G. for the coming election. If so, I thank you. Sincerely, Edmund."

Howard H. Hibbard, son of Mr. and Mrs. E. R. Hibbard, has a right to feel that things are coming his way in a very satisfactory manner. He recently was elected vice-president of his father's concern, the Grip Nut Company. Now the *Daily* learns that on June 26 Mr. Hibbard, who is here attending the conventions, is to be married, in Minneapolis, to Miss Eleanor Stowell, a daughter of Mr. and Mrs. F. M. Stowell, of that city. The father of the bride-to-be is president of the Northwestern Knitting Company. Following the wedding, the young couple will tour in a new Mercer automobile which Mr. Hibbard, Sr., has presented to his son, although just where they will take their tour is as yet undisclosed. After August 1 they will be at home at the Blackstone Hotel, in Chicago.

Among the operating officers in attendance at the convention is M. J. Caples, vice-president of the Hocking Valley. Mr. Caples has given considerable thought to the question of preparedness and is thoroughly convinced, if we are to be really prepared, that it will be necessary to change the public school systems of this country and provide for vocational training, as has been done to such splendid advantage in Germany.

Mrs. Harry E. Passmore is an enthusiast among the convention ladies, being a most willing worker in the social events. She was not at the conventions last year, or the year before. She is now completing a recovery from a recent illness. Mr. Passmore is also here, but it is the general belief among his friends that in view of his record as an umpire, he will not be asked to officiate in the game of Saturday.

Among the most enthusiastic boosters of the Chief Interchange Car Inspectors' and General Foremen's Association who are attending the Master Car Builders' convention is the president, A. Kipp, general car inspector of the New York, Ontario & Western. He says it is quite probable there will be a large addition to the association membership in the coming months because of the membership campaign which is now under way.

R. G. Gilbride, formerly locomotive foreman of the Grand Trunk Pacific, at Graham, Ont., paid a brief visit to the convention on Thursday morning. Mr. Gilbride is a cousin of Bruce Robb, who was recently wounded while in service with the British Army in France. He reports that Mr. Robb is now getting along nicely. Mr. Gilbride has twelve cousins taking part in the war. He himself is engaged in manufacturing munitions at Montreal.

A. L. Humphrey, of the Westinghouse Air Brake Company, is receiving congratulations right and left for the splendid preparedness demonstration which the Westinghouse Air Brake Company gave at Wilmerding on Monday, June 5. It is doubtful if any more effective means could have been taken to awaken railway mechanical department men to the necessity for giving attention and thorough study to the demands that may be made upon them in case of war.

For the first time since he has succeeded to his present position, John E. O'Brien, mechanical superintendent of the Missouri Pacific, is attending the Master Car Builders' convention. While the impression may be apparent that some of the roads in the Southwest have been having a difficult time during the part year or two, Jack's appearance, if it is any indication of the condition of the road for which he works, would indicate that prosperity is reigning supreme at the present time.

W. F. Drysdale, of the American Locomotive Foreign Sales Corporation, is attending the conventions in company with Charles Dombey, engineer delegate representing the Madrid Saragosse and Alicante Railroad Company of Spain. Mr. Dombey has been at Schenectady since last November and is supervising the inspection of 25 locomotives being built for his road by the American Locomotive Company. He was born in Paris and is a graduate of the Ecole des Arts et Metiers, which is a French engineering school. He is a vet-

eran of the Franco-Prussian war of 1870 (Officer d'Instruction Publique). The railroad which Mr. Dombey represents is the largest in Spain, running from the northern corner of the country to Cadiz. The traffic consists largely of olives, oranges and other Spanish fruits, although the road is also a carrier of minerals, particularly copper.

"Show me the man who said that I was a fiction instead of a fact, as tangible as the lugs that I carry. I am here in person to prove that I am real, although distinct, separate and apart from all others." That's the gist of Battery Bill's letter to those who are attending the convention this year. Nothing that we know of in publicity work is so timely as the arrival of Battery Bill at the Edison headquarters. As one railway man put it: "Like Cæsar I came, I saw, and by Heck, I'm convinced that Battery Bill is here."

Seeing Ben Hegeman and Bert Waycott on the hotel porch with their heads close together reminded us of those days long since passed when a band of conspirators, of which the aforesaid two B's were prominent members, shaped the destinies of what is now the Railway Supply Manufacturers' Association. "Them was the good old days" when, knowing Ben, Bert, Harry Frost and a few other members of the clan, were all that was necessary for a committee chairmanship or membership. Nowadays it's very different. You've got to be a real one, if you want a committee job.

The number of enthusiastic advocates of up-to-date apprenticeship methods in the car department is increasing rapidly. It is doubtful, however, if any of them are prepared to advocate it more strongly than John Purcell, assistant to vice-president, Atchison, Topeka & Santa Fe. His road has had remarkably good results in carrying on educational work among the car department employes, and at the conference of the apprentice instructors, which was held at Topeka three weeks ago, a large part of the program was given over to the consideration of detail methods which are being used in that work.

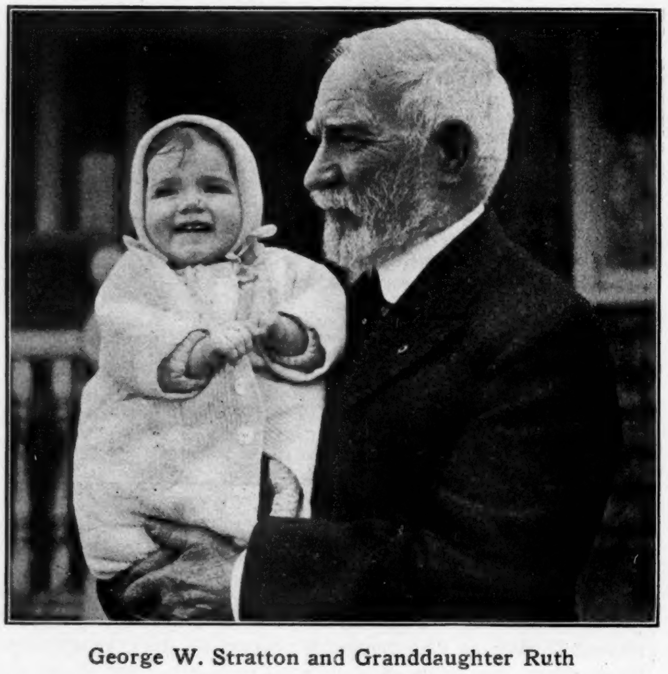
There was a trip hammer giving daily exhibitions next to Tom O'Malley's exhibit on the pier, but that trip hammer is no more "doin' stunts" next to friend Thomas' show—and the queer part of the story is that the hammer is still hammering and has not been moved. It's no "How old is Ann?" conundrum either. Tom thought he had a good voice and for a day or two he shouted "with might and main" to the many who came to his booth. But at last the bloomin' machine conquered over nature and Tom gave up. He did not move the hammer, but he did move himself and his show—and he is now installed in a larger space in a better location.

John A. Pilcher, mechanical engineer of the Norfolk & Western, is having a lively time this year. He is accompanied by Mrs. Pilcher and his three sons, Robert Mason, age 13; John A., Jr., age 11, and William, age 5. On Wednesday the members of the family became badly scattered and had a pretty hard time rounding each other up and getting together again. The 180,000 lb. capacity cars, designed by Mr. Pilcher, of which there are 750 now in service and 1,000 more building, are about the only ones outside of the heavy capacity freight cars owned by the Pennsylvania which have sufficient capacity to transport the larger guns now used by the United States army.

R. L. McIntosh has become associated with the Pyle National Company as special representative. Mr. McIntosh was born in Milwaukee, Wis., and served his time as a machinist apprentice on the Erie at Susquehanna, Pa., and with the Chicago, Milwaukee & St. Paul at West Milwaukee. He has a wide railroad experience in the mechanical department, having been connected with a number of railroads in the northwest and west in connection with practical shop and road work and in the testing and designing departments. He was assistant mechanical engineer of the Missouri Pacific under W. H. V. Rosing. He left that position to become works engineer of the Commonwealth Steel Company at St. Louis and was later connected with McCord & Co. For several years he has been interested in special engineering work, having acquired an interest in several railway equipment devices.

Edmond Ramond, inspector of the Paris-Lyon-Mediterranean Railway at Paris and Giovanni Davio, C. E., inspector of the Italian State Railways, have been giving considerable attention to the exhibits. Mr. Ramond has been in this country for the last seven months and is at present living at Lewistown, Pa. Mr. Davio makes his headquarters at Pittsburgh and has been here for a year. Both spent their time in inspecting railway materials that are being made in America for their respective companies.

The accompanying photograph, taken in March last, shows George W. Stratton, formerly master mechanic of the Pennsylvania Railroad at Altoona, holding his young granddaughter, Ruth Ferrier Stratton. Little Ruth, who was born on April 1, 1915, is in turn the daughter of G. E. Stratton, inspector of passenger equipment of the Pennsylvania Rail-



George W. Stratton and Granddaughter Ruth

road at Philadelphia, who is attending the convention. Grandpa Stratton, who happens to be the father-in-law of C. E. Postlethwaite, of the Pressed Steel Car Company, is nearly eighty years old, and, as his picture clearly shows, is hale and hearty. He was retired when he reached the age limit ten years ago.

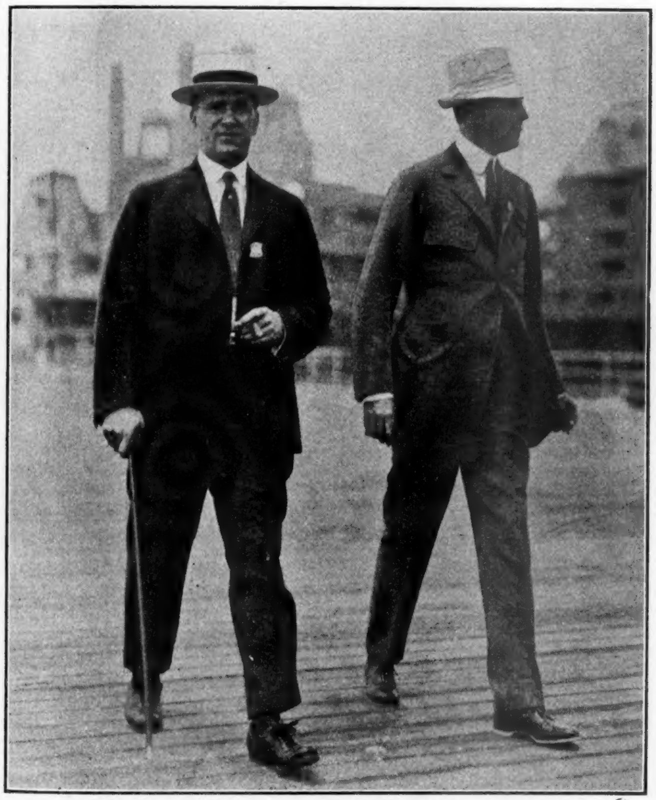
Probably no mechanical department officer in the country is more interested in, or has given more attention to the subject of preparedness, so far as it relates to the utilization of that department in case of war, than D. F. Crawford. As he said in speaking to the guests who attended the preparedness demonstration of the Westinghouse Air Brake Company at Wilmerding early in the month, every railroad officer should familiarize himself with artillery and also the type and amount of car equipment which will have to be used to transport bodies of troops and supplies by rail. One of the big problems which we shall have to confront in case of war

will be the providing of satisfactory cars for transporting the larger guns. As noted in the address which Vice-President Park, of the Illinois Central, gave at New Orleans a few weeks ago, the Pennsylvania and the Norfolk & Western are the only roads which have equipment that can handle the larger guns.

President Ostby, of the Railway Supply Manufacturers' Association, has sent the following letter to W. R. Powe, chairman of the Southern Classification Committee, which is now holding a conference in Atlantic City.

"Learning that your Committee was sitting in Atlantic City, and believing that you would be interested in looking over the exhibition that our Association has installed on Young's Million Dollar Pier, we cordially extend to you and the Committee an invitation to visit the pier and spend such time in the exhibits and with the exhibitors that you care to.

"If you will designate an hour and day before Tuesday next when it will be convenient for you to come, we will arrange to have you met at the entrance to the pier and the courtesies extended."



Oscar F. Ostby and George Hodges, Chairman of A. R. A. Committee on Relations Between Railroads in M. C. B. March

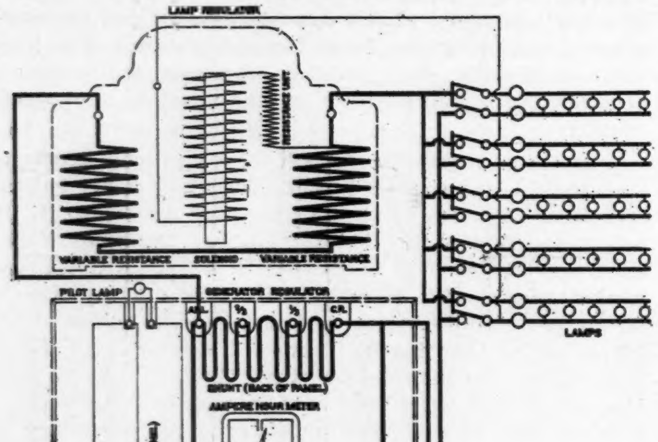
Charlie Storrs has recently returned, looking weather-beaten and brown, from a most interesting four and one-half months' trip in South America. With his 14-year old son, A. P. Storrs III, and two others, he left New York in January, bound for the southland in a search for mica. Owing to the embargo on this material from European countries the supply had been seriously curtailed. Members of the Storrs party, on their arrival at Rio Janeiro, Brazil, were each "shot," hypodermically, for typhoid fever and then at once plunged 300 miles into the interior of the country. Obstacles were everywhere met. No handsome, modern trains, either steam or electric, nor Pullman cars were known in this country. Instead, a train of 13 horses and mules was used to pack the passengers and outfit, consisting of tents, food and cooking utensils. A rough country was traversed and two mountain ranges crossed. The rainy season commenced, mosquitos, carraptos and poisonous fleas were everywhere in evidence and it was anything but plain sailing and pleasure and romance. A part of the time the three men of the party and the boy were compelled to walk mile after mile. They forded flooded streams, lived in a native village for a week in order to repair tattered garments and replenish their stores, and finally reached partial civilization, where the horses and mules were disposed of and a 30-ft. dugout canoe secured. In this they went downstream of a large river to the final objective point, where the mica mines were located. The return journey to Rio Janeiro was made; then to San Paulo, Santos and over the Andes to Santiago and Valparaiso; thence to the Panama Canal and Colon. The trip was entirely successful, both from a business standpoint and in the way of a delightful and ever to be remembered experience. It may be added, in closing, that although the trip may perchance be forgotten, as a whole, there were certain details that will forever live in memory's vision; for instance, the one ever-served food furnished in that native village—a "mess of muss" consisting of rice and black beans and pieces of chicken, particularly the heads containing staring eyes, looking vacantly into space. Chicken heads, also the claws, are considered the choice pieces of the fowl in that queer country.

It has become quite the fashion for sympathetic people to start chain letters to their friends asking that money be sent to persons that they think are needy and deserving. E. B. Leigh, president of the Chicago Railway Equipment Company, recently received such a letter which he noted was marked "Series 47." It asked that he send 10 cents to a certain retired railway man, and that he write to five of his friends asking that they do likewise. This started Mr. Leigh to reflecting, and his reflector caused the fact to dawn upon him that if this letter were sent to each of five people in 47 series, and each of them should send the beneficiary 10 cents, the beneficiary would become an exceedingly rich man. The result was that he took his pencil in hand and made a calculation to ascertain exactly how many people would contribute and how much they would give. Having ascertained these facts, he wrote the man who had sent him the letter as follows: "I was beginning to feel encouraged that you were not headed for the insane asylum until I received your "chain letter" of April 7. I haven't the time to write you as fully as I would wish, but assuming that you are telling the truth and that your letter to me is series 47, this would mean that there have already been written 142,-000,000,000,000,000,000,000,000,000,000 letters. I will further call your attention that if there had only been 12 series written, it would mean 305,175,820 letters—over three times the present population of the United States and I believe there is included in this total population quite a number who are not yet able to write. I will further call your attention that the total population of the world is 1,747,208,990. I think you will recognize that there are a whole lot of people who are too busy to write letters on the lines you have suggested." By a simple calculation it can be learned that if only 12 full series of letters had been written, and the desired dimes sent the total sum received by their beneficiary would have been $3,051,758; and if he had received money as a result of all the letters in 47 series, he would have received a billion or more times the total wealth of all the world! It takes a man who is "mathematically-minded," as the late James J. Hill used to say, to ventilate a matter that lends itself to the kind of treatment Mr. Leigh gave this chain letter business, and it is to be wished that his analysis could receive the widest circulation. It would save many people a lot of annoyance.

New Devices

CONSOLIDATED AXLE LIGHT PANEL

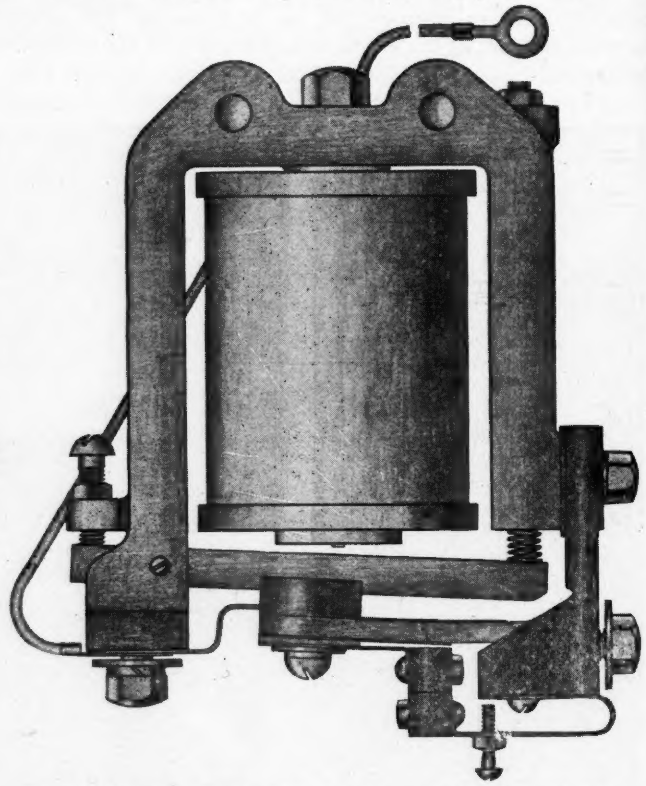
The ampere-hour meter control of the Consolidated axle light equipments, which has given such satisfactory results in reducing the cost of operation of car lighting equipments, has been still further improved by the Consolidated Railway Electric Light & Equipment Company, New York, so that the same meter that controls the battery charging current from the car lighting generator and discontinues the current to the storage batteries when the batteries have become fully charged is now employed for the additional purpose of controlling the current supplied to the car while being charged



Connection Diagram for New Consolidated Axle Light Panel

from an outside source; as for example, when standing in the railroad yards.

It has been found that when cars are charged from the yard service mains while standing in the yards, that the storage batteries are frequently overcharged by reason of the car being left on charge for too long a period. By a slight change in the arrangement of the circuits of the Consolidated Axle Light System, the apere-hour meter is caused to register the amount of charging that the battery receives from the yard plant, and by the arrangement shown in the wiring diagram herewith, when the meter registers "full charge" of



Circuit Breaker Used with the New Panel for Opening Outside Charging Receptacle Circuit when Battery is Fully Charged

the battery, the contact switch is closed by the meter hand, which causes the circuit breaker to operate and disconnect the charging mains from the battery so that the battery will receive no further charge.

OIL PUMPS WITH QUICK RETURN STROKE

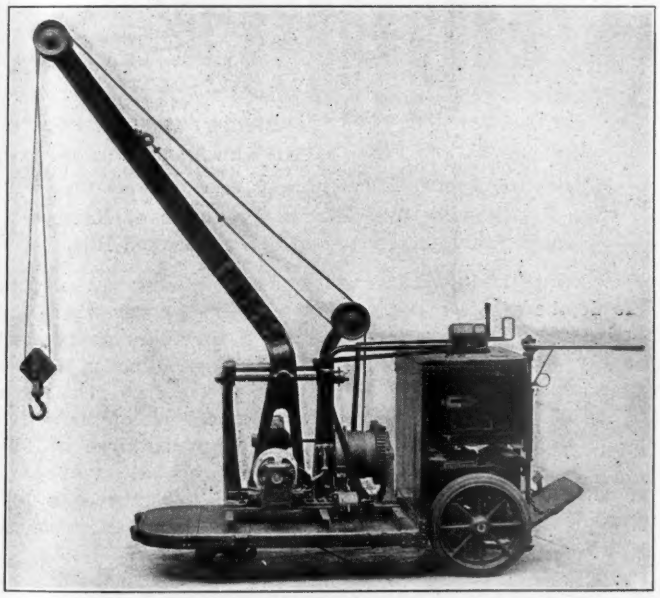
Included in the exhibit of S. F. Bowser & Co., Inc., Fort Wayne, Ind., are two oil pumps in the design of which several features of interest have been incorporated. In these two pumps, which are practically the same with the exception that one is designed for the handling of volatile oil, while the other is designed for the handling of non-volatile oil, the operating mechanism includes an arrangement of two cut steel cog racks and double gears. By this means a quick acting feature has been incorporated whereby the plunger is returned at a speed four times as fast as that of the lifting stroke. This arrangement also makes possible the uniform distribution of the weight of the plunger when lifting, which facilitates the operation of the pump.

A positive opening and closing valve is provided which as-

sists the foot valve in retaining the liquid in the pump and suction pipe, thereby providing an additional assurance of accuracy of measurement. Each pump is provided with a continuous recording meter which registers up to 100,000 gal. and then automatically repeats. In addition to this a 100 gal. discharge register is provided to facilitate keeping tally of quantities delivered into large containers. Both pumps are provided with enclosed locks operated by a push button, which prevent the use of the pumps by unauthorized persons.

ELEVATING PLATFORM TRUCK

The Elwell-Parker Electric Company of Cleveland, Ohio, has placed on the market a new Platform Elevating Truck which has been designed after a careful study of industrial conditions and extended tests in actual operation. The truck embodies many of the features common to all Elwell-Parker trucks, as well as many new features which will especially interest mechanical department officers. The operator must stand in an upright position on the small platform in front. In his right hand he has the steering lever which he merely points in the direction he wishes to go; in his left hand is the controller handle which he pulls up to go forward at any



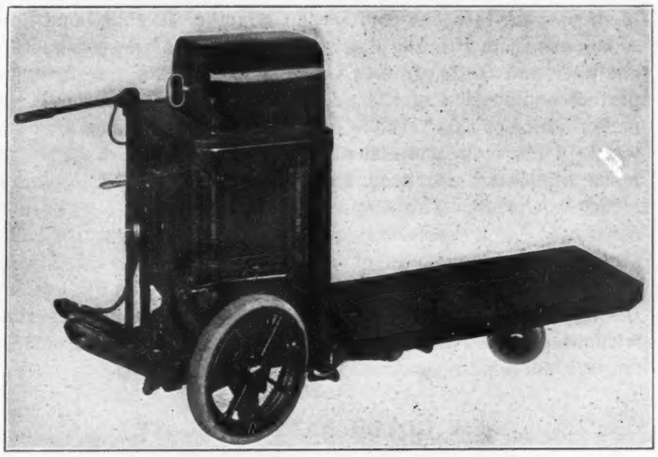
The truck steers from all four wheels. Drives on two front wheels. Motor racks boom and by shifting gears the same motor is used for shifting 1,000-lb. load.

New Low Bed Truck with Electrically Operated Crane Hoist

one of three speeds, releases to stop, and pushes down to reverse. The brake is automatically applied by the operator raising his right foot, and it has such a high efficiency that the truck will stop in 14 ins. when going at full speed. The instant the operator leaves the truck, even though running at full speed, the brakes are applied, automatically; the controller goes to the "off" position, the circuit to the motor is disconnected and the machine is locked until he again returns to the operating platform. All of these features have been highly commended by safety-first organizations throughout the country.

The loading platform is only 11½ ins. over the floor. making it possible to carry greater loads, and offering a great advantage in loading heavy packages. The steering is accomplished by all four wheels automatically taking the same radius of curve, permitting operation in narrow aisles and under congested conditions.

The driving mechanism is a worm gear operated by a motor, both simple and rugged in construction. The operator merely runs the truck under the loaded platform, starts the motor and the platform loaded with 4,000 lbs., is raised 3 ins., resting securely on the truck. The lifting device automatically stops itself when the platform reaches it maximum height and the truck takes the load to any point desired; then the platform is lowered without jolt or jar and the truck is run out from under it. It requires 10 seconds to lift the platform loaded with 4,000 lb. and seven seconds to drop it. The



Pulling a lever will automatically raise a 4,000-lb. load in 10 sec. and lower it in 7 sec. Steers on four wheels and drives on the two forward ones.

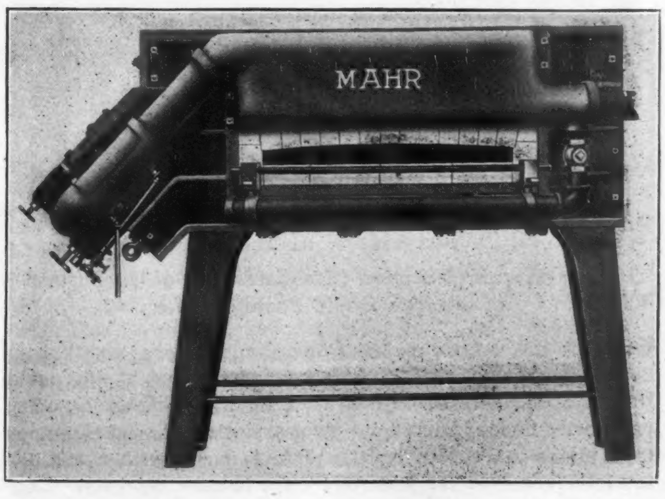
Elevating Platform Type Truck

wooden loading platforms can be made at small cost to meet special conditions.

It is not necessary for the operator to leave the truck when lifting or lowering the load and it is evident that there will be a saving in time and labor by the use of this machine; to say nothing of its possibilities in increasing the output and decreasing the cost of production. Vanadium steel and drop forgings are used; also Timken and Hess-Bright ball bearings, Goodrich or Goodyear solid rubber metal base tires, etc.

OIL BURNING FORGE FURNACES

The Mahr Manufacturing Company, Minneapolis, Minn., has on exhibition this year a new type of forging furnace which has several interesting features. The old familiar water



Oil Furnace with Air-Cooled Front

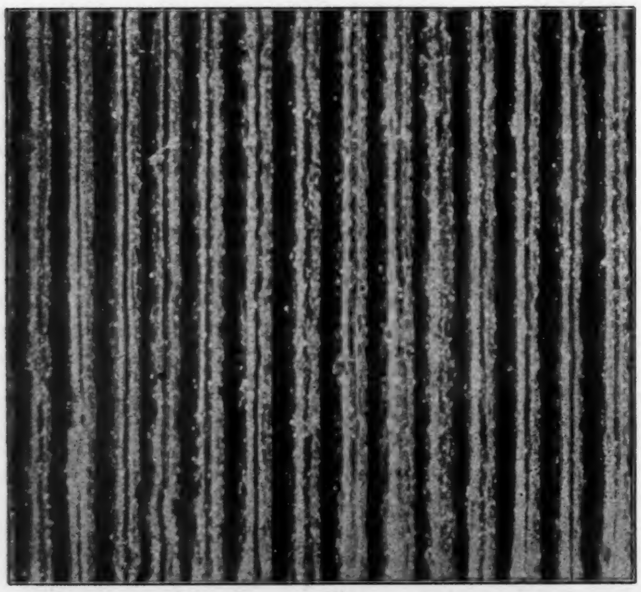
screen for the protection of the workmen is entirely eliminated. A hollow chamber through which passes the air used in atomizing the oil extends across the front of the furnace above the opening, as shown in the illustration. At the en-

trance to this chamber a portion of the air is led down to a point below the furnace, opening into a perforated pipe which forms another air screen. From this chamber the air passes to the atomizing valve.

An oil chamber is formed in the lower end of the lead shown at the left side of the illustration, the oil passing up through this chamber where it is preheated. From there it passes to the atomizing valve, being at such a temperature that when the hot air strikes it it becomes immediately gasified, passing into the combustion chamber in that condition. A by-pass from the air pipe passes up above the combustion chamber and feeds air into the furnace, in this way insuring perfect combustion of the oil. An interesting feature in the performance of this furnace is the lack of scale formed on the work. This is accomplished by having a neutral flame, no more air being admitted than is necessary to thoroughly consume the oil. The flow of the air through the by-pass is controlled by a valve, as is the air and oil mixture. The atomizing valve also is of a distinctive design. It is constructed on the piston valve principle and permits passing the impurities in the oil through to the combustion chamber without clogging the valve. Patents have been applied for on this particular feature.

NEW GOULD BATTERY PLATE

The Gould Storage Battery Company, New York, has recently placed on the market a new positive plate for its storage battery, the result of some new methods in battery plate manufacture, which make it radically different from the positive plates manufactured by that company heretofore. This new plate is formed by a special process which

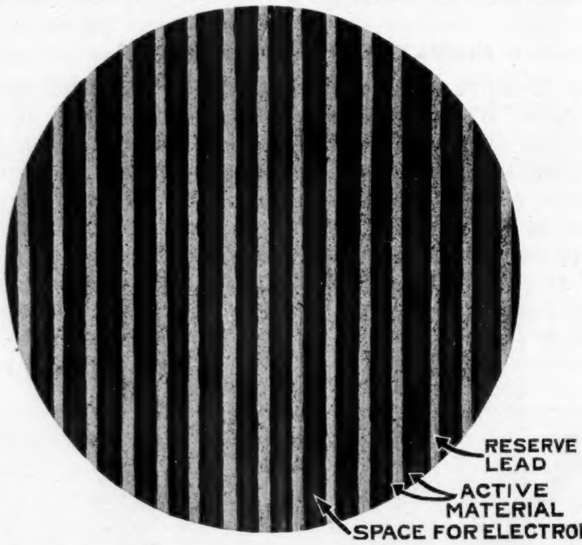


Note the Space Between Ribs and Also the Crystalline Structure of the Plate as Shown by the Tiny White Dots

Fig. 1.—Magnified Section (five diameters) of the Surface of the New Gould Positive Plate

produces the active material in a much more highly condensed form than in the older type plates and at the same time the active material has a considerably higher capacity per square inch of superficial plate area than that of the older type plates. Accordingly, the plate is made with a smaller total surface area for a certain total battery capacity. This makes it possible to use a smaller number of ribs, allowing them to be made with considerably heavier section and wider space between ribs for the electrolyte than could be provided in the older type of plate.

As a result, the new method of formation apparently gives two distinct advantages. First, there is a somewhat heavier section of reserve lead in the ribs of the plate which is made use of for future conversion to peroxide. When there is no more reserve lead left in the ribs of a plate, the battery is about at the end of its life. Therefore, the more reserve lead provided, the longer will be the battery life. The second advantage is found in that the active material being formed in a thin but very dense skin over the surface of the ribs; the grooves between ribs are left open clear to the bottom, permitting of free circulation of electrolyte. This should remove one of the chief causes of battery sulphation,

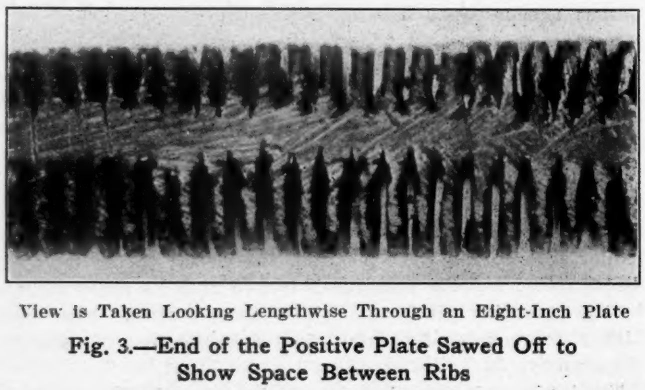


This View Was Made by Filling a Plate with Sealing Wax and Then Planing It Off Carefully. The White is Reserve Lead, the Black is Active Material and the Gray is Space Between Ribs

Fig. 2.—Showing the Relative Thickness of Reserve Lead, Active Material, and Space Between Ribs

that due to highly concentrated acid becoming pocketed in the depths of the plate, as may sometimes occur where the active material is formed to such a thickness as to completely fill the space between the ribs. Moreover, as the wider spacing of the new plate allows a free circulation of the electrolyte, the diffusion of the acid out of the active material on charge and into it again on discharge will be very materially assisted. Accordingly, the battery gives a somewhat higher voltage on discharge and reaches a full state of charge at a slightly lower voltage than is experienced with the older type of plate.

Another important advantage with the new plate is that even if it may become badly sulphated, the active material



View is Taken Looking Lengthwise Through an Eight-Inch Plate

Fig. 3.—End of the Positive Plate Sawed Off to Show Space Between Ribs

never completely fills the space between the ribs and accordingly cannot set up expansion strains that cause buckling of the plate.

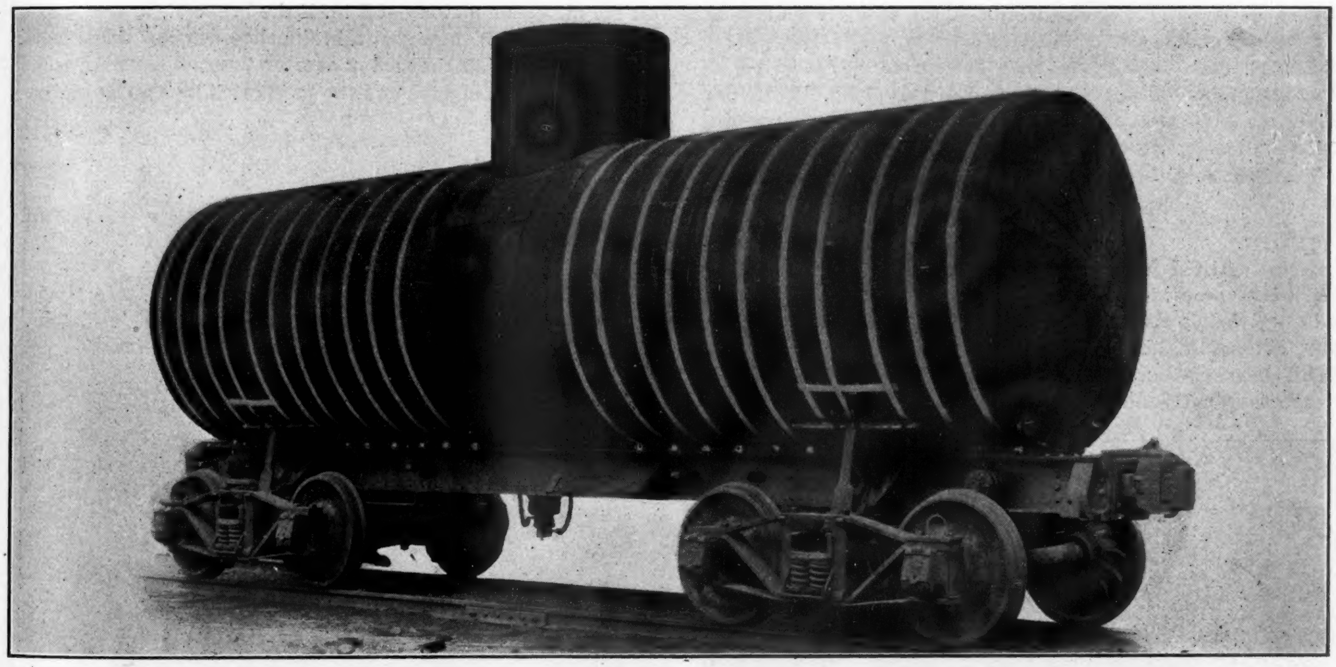
The mechanical features of the new plate are also of considerable interest, for the ribs, being considerably heavier than in the older plates, will stiffen it materially and tend to prevent buckling. Moreover, since the space between ribs is considerably wider than in the former type of plate and

with the active material existing in the form of a very thin skin, there will be much more space allowed for the expansion of the active material when it becomes sulphated. The result of this is that even if the active material may become badly sulphated, there is ample room provided for the consequent swelling of the active material. This cannot set up expansion strains in the plate itself, for it is these expansive strains, due to the fact that there was not sufficient room for the active material to expand on sulphation, that caused buckling in the earlier type of plates.

No forming acids whatever are used in the plate manufacture, therefore there will be no impurities introduced into the battery from this source, and excessive formation of the plates in this service will be eliminated. The active material of the new plates is pure lead peroxide in a crystalline form.

CORKBOARD INSULATION FOR TANK CARS

During the past year the use of corkboard for the insulation of tank cars carrying volatile oils has been developed by the Armstrong Cork Company, Pittsburgh, Pa., and a model tank car showing the method of applying and jacketing the corkboard insulation is included in this company's exhibit at Atlantic City. The corkboard is applied to the shell in rectangular strips, running around the barrel, instead of longitudinally as in the case of the lagging of a locomotive boiler. Flexibility is secured by transverse groovings on the under sides of the strips, and they are secured by staples and metal bands which extend around the tank and are secured to the underframe The lagging on the ends is placed in radial, tapered strips, as shown in the illustration, which shows the application of this material to a car built by the Standard Steel Car Company, Butler, Pa.



Tank Car with Corkboard Lagging Ready for the Jacket

A barrel jacket is applied in two sections, one on the under side of the car, and the other over the top, the top section extending below the center line. The two sections are provided with angle bolting flanges and are closed by a slip joint which entirely covers the lagging. The end is jacketed with one piece provided with an outwardly extending bolting flange, which fits inside the barrel jacket and is bolted thereto. To remove the jacket for inspection or repairs these bolts, and those in the horizontal barrel joints, are removed, when the top section may be lifted off in one piece and the ends removed.

This material is light in weight and can easily be applied. Its structure is such that there is comparatively little loss from breakage in handling. While it is not absolutely fireproof it is extremely slow-burning. Tests are said to have indicated that in case of exposure of the car to fire, ample time is available in which to remove the car to safety and extinguish the fire in the lagging before it will have burned far enough through to endanger the contents of the tank.

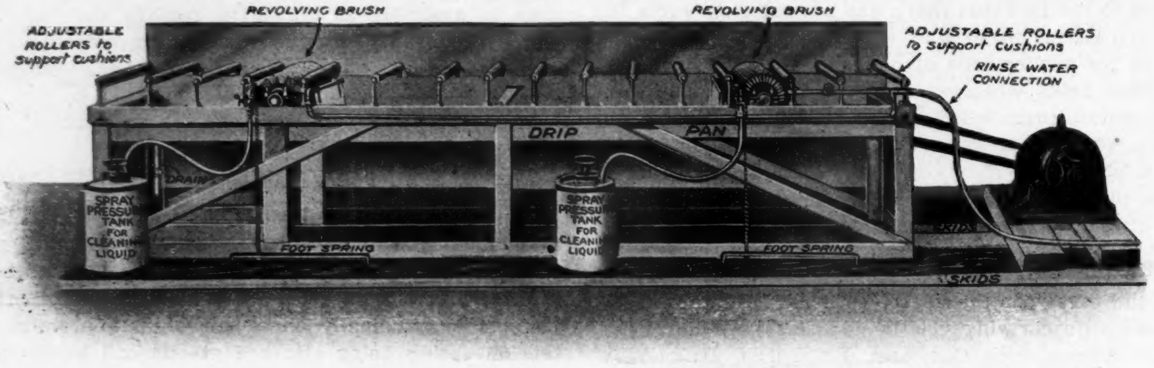
E. S. B. BODY-HUNG AXLE GENERATOR

The Electric Storage Battery Company, Philadelphia, Pa., in connection with its constant voltage axle lighting system, is exhibiting a new body-hung generator and suspension. The machine is hung from a cast steel frame or carriage, adjustable longitudinally on a pair of parallel rails, the belt tension spring being attached at one end to the generator frame and at the other end to a fixed point in the steel carriage. The carriage may be locked in any desired position on the rails by means of two cams. The belt tension is adjusted by sliding the carriage towards or away from the truck, the amount of tension being indicated by the angular position of the generator. Any stretch of belt may be quickly taken up without cutting, by sliding the carriage away from the truck until the generator assumes its normal angular position. Similarly, if it becomes necessary to cut out a defective portion of the belt, the belt may be shortened while still permitting adjustment for normal tension, thus avoiding an extra joint.

The same company is also exhibiting a new design of car-lighting battery. The elements are assembled in two-cell units of the slatted crate type, the lead-linings being separated from the wood work by sheets of specially treated tar-felt. The covers are of lead-alloy, sealed either by lead-burning or sealing compound as preferred. A large vent-opening is provided, covered with a lead vent cap held in place by its own weight, and so designed as to provide a spray trap to prevent the escape of acid spray.

CUSHION CLEANING MACHINE

In order to expedite the cleaning of plush or cane cushions and aisle strips in passenger cars a machine has been developed by the Imperial Car Cleaner Company, Newark, N. J. It consists of a roller table, in which is placed a motor-operated cleaning brush or brushes. The cushions are moved on the rollers over the brushes, at the same time receiving a spray of special cleaning liquid furnished by the manufacturer of the machine. The operation of the spray is controlled by a foot lever in front of the table.



Imperial Two-Brush Cushion-Cleaning Machine

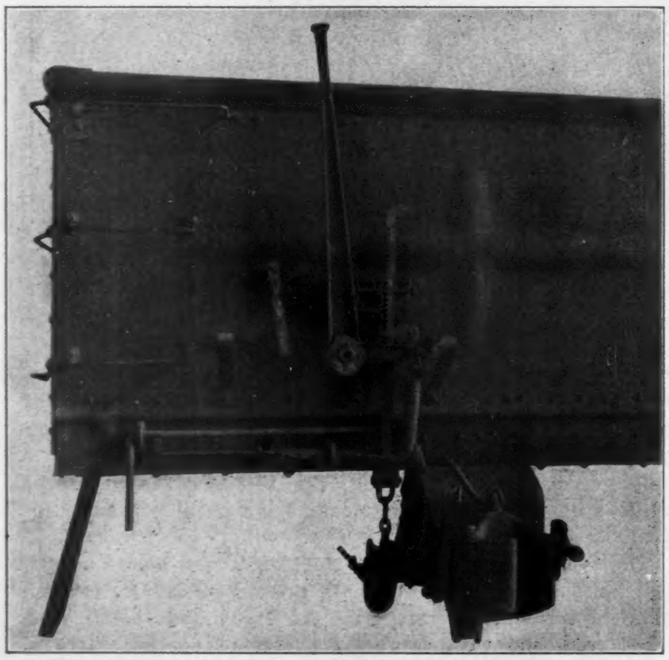
The operation is dustless, and is said to be effective in removing stains or discolorations from the plush. With the double machine two men are said to be able to clean the cushions of about 12 cars per day.

The machines are ordinarily not sold, but are loaned for use with the cleaning products furnished by the company.

QUICK ACTION LEVER HAND BRAKE

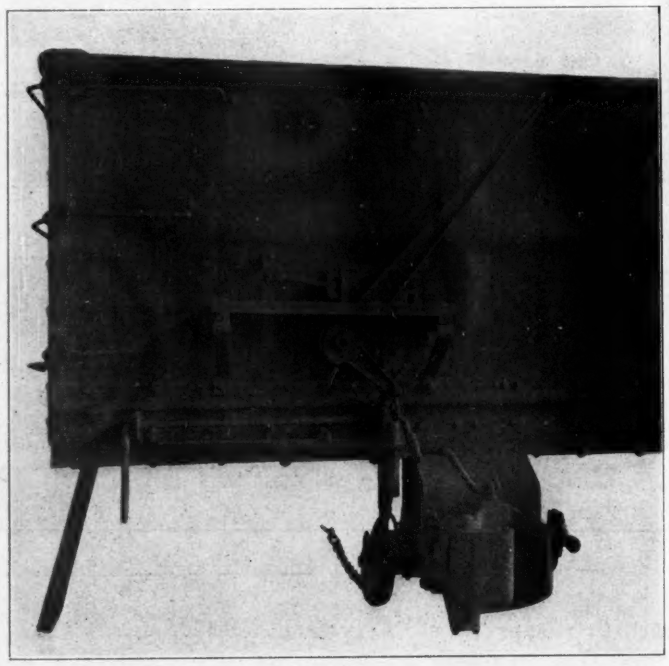
A lever operated hand brake with a quick slack take-up feature is being exhibited this year by the Bettendorf Company, Bettendorf, Ia.

This brake is designed to give a high hand brake force, irrespective of the air brake piston travel, this being accomplished by means of a rack operated by a lever and pawl so that the force delivered to the cylinder lever is always constant for a given initial force at the hand brake handle. The straight line action of the rack for the entire stroke avoids the results obtained with the customary staff when the chain winds upon itself and reduces the effectiveness of the force delivered.



Casing Removed to show Operation of the Brake

The quick action feature is effected by the use of a lever arm longer than the radius of the pawl connection, to which is connected a spring attached to the lower end of the rack in such a manner that the first stroke of the hand lever will pull the air brake piston out 8 in. if the brake shoe wear gives sufficient slack. If, however, a brake shoe engages the wheels and offers a force to the spring greater than its normal resistance the spring elongates and the pawl with its shorter radius arm engages the rack, the force thus automatically increasing at the instant the slack has been taken up.



High Power, Quick Action, Lever Hand Brake

The hand brake lever is pivoted in a casting attached to the car body and has the equivalent of two power arms; one connected to a pawl with a short radius acting directly on a rack, the other a longer arm connected to the lower end of the rack by means of the tension spring.

The arrangement of the device on exhibition and as here illustrated, is for gondola cars, but it can readily be adapted to box or flat cars. When used on an end platform it is claimed to offer greater convenience and safety to the brakeman or switchman than does the present day equipment.
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WE GUARANTEE that of this issue 12,715 copies were printed; that of these 12,715 copies, 11,244 were mailed to regular paid subscribers to the Railway Age Gazette and the Railway Mechanical Engineer; 171 were mailed to advertisers, 300 were provided for counter and news companies' sales, new subscriptions, bound volumes, copies lost in the mail and office use; and 1,000 copies for distribution at Atlantic City.

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Air Brake Maintenance

There is no question that the subject of the maintenance of air brakes on freight equipment is deserving of the most serious consideration. With the greatly increased length of trains and more severe operating conditions, it is absolutely necessary that the equipment be so maintained that it can be properly handled. The matter of expense, which has so largely entered into the problem, is no argument for the continuation of the neglect that has prevailed. Money could not be spent to any better advantage, as experience has shown. An experiment was tried on one of the western roads on which there are heavy grades. The brakes on the cars were placed in a highly efficient operating condition and it was found possible to increase the length of train 50 per cent. The money saved by this procedure far exceeded the cost of maintaining the brakes. Nor is this the only advantage; trains can be operated at higher speeds and less trouble will be experienced from break-in-twos. In order to maintain the valves in good condition it is necessary that the brake repairmen be thoroughly educated and taught to do their work more efficiently. Better inspection must be given, and it must be insisted that the work be thoroughly done. The triple valve is not the only source of trouble. In many cases the brake cylinder is not properly cleaned, due to a lack of instruction in this work. On one road it has been found profitable to install brake cylinders in a testing rack for the purpose of seeing that the cylinder packing is in good shape. A packing leather may appear to be in good condition, but be so porous that air leakage in the brake cylinder will be excessive. Thorough inspection and supervision are vitally necessary.

Freight Car Apprentices

The Sante Fe, in inaugurating an apprentice course for the instruction of young men in freight car repairs, has laid a foundation for a class of railway mechanics that is certainly needed all over the country. This course has been in operation for about two years and as the term calls for two and a half years, the full results of the work have not been realized. However, the development of the young men thus far has proved the practicability of the course. They are handled in the field by shop instructors, and are assigned to work on various parts of the car in gangs made up of apprentices. The shop instructor first shows them what is to be done and how it should be done. As the men become more efficient they are left more to their own resources and the older apprentices find an opportunity to work with the regular workmen. It is in these gangs that the results of their instruction are shown. It has been found that the boys are fully capable of holding their own with the more experienced workmen. In addition to the car repair work, the young men are given a thorough course of instruction in the M. C. B. rules, both in the classroom and by the shop instructors in the field. From the experience thus far it is believed that the time and effort spent in developing these men will prove a most profitable investment.

Welding Cast Steel Truck Frames

In connection with the welding of cast steel truck side frames and bolsters careful consideration should be given to Mr. Wallis' minority report. The electric and oxy-acetylene welding methods have proved of the utmost value in many lines of locomotive and car work, but there is not enough known as to the strength and general character of such welds to warrant their general use in members where the stresses are of the nature that they are in truck frames. While it is no doubt true that such roads as the Central of Georgia and the Pittsburgh & Lake Erie have had excellent results from the welding of these members, it does not follow that the welding which would be done throughout the country would be of such a character as to justify the association in taking a stand for favoring the practice. There is sound argument in what J. J. Hennessey said regarding the cost to the railroads of scrapping every cracked side frame. As he says, they are not likely to stop welding side frames and bolsters, at least not for the present; but the action on the report in providing for a committee to investigate the subject and bring in definite recommendations as to how the work of welding should be performed, if it is decided that these members can be satisfactorily and safely welded, is commendable and we feel that it would be well to postpone the use of the welding processes in making repairs to these parts until something definite is reported by the committee.

The Use of the M. C. B. Loading Rules

The committee on loading rules brings out a point in connection with the use of these rules which all the members of the Master Car Builders' Association should try to follow up. The loading rules are the best that the committee has been able to develop from time to time and it is believed that they are reasonable, provide ample safety and are satisfactory to both the shippers and the railroads. This is brought out as regards the shippers by the investigation made by the committee, of the loading conditions in the Bedford stone district of Indiana.

When the committee requested both the shippers and those railroads which were interested to make any further suggestions as to improvements in the rules for the loading and shipment of stone, they expressed themselves as satisfied with the rules as they stood, these particular rules having been formed with the assistance of all who were interested. Notwithstanding this, the committee states that some roads are still accepting shipments which are improperly staked and furnishing the necessary stakes, etc., to bring them up to the requirements of the rules after the shipments reach their lines. The suggestion of the committee is a good one, that the roads take sufficient interest in this matter to see that copies of the code of loading rules reach the various factories on their lines, and further that they take active steps toward seeing that those who have to use them are familiar with their meaning. If questions arise which seem to require further information from the committee it is an easy matter to take them up with the chairman, but the rules are the best that are now obtainable and if they are made proper use of it is believed they will produce satisfactory results. To produce such results, however, requires the continued co-operation of both the shippers and the railroads.

An Effect of Poor Car Construction

We have pointed out on various occasions in the past the false economy of purchasing cheap and consequently poorly constructed cars. There are railway officers who do not seem to be able to see beyond the first cost nor to realize that it is poor economy to hold cars out of service for repairs or to purchase the type of cars that, while cheap in first cost, run into excessive amount for upkeep. There is a reasonable balance which can be obtained between first cost and cost of repairs with the result that the car, while originally costing a little more, will be a better revenue earner. It is known that a committee of the American Railway Association is now working on the development of a standard box car and it is also well known that a good many railway men are not in favor of a standard car. It is not intended at this time to comment favorably or otherwise on such a car. What is intended is merely to point out to those false economists who are placing in interchange service box cars which are inadequately designed and poorly constructed, that they are doing the best they possibly can to hasten the adoption of a standard box car. For when the standard box car comes, if it does come, it can be depended on that it will be well designed and the specifications will be of such character as to prevent the construction of flimsy cars that will spend a large part of their time on the repair track.

Defective Freight Equipment

One hundred and twelve roads reporting to the American Railway Association the amounts paid for loss and damage to freight in the calendar years 1914 and 1915 showed a reduction of payments for the latter year of seven and a half millions, or 24 per cent—this in spite of a slight increase in operating revenue for 1915. It would be interesting to know just how much of this saving was due to improvements which have been made in car design, construction and maintenance. In a report made by a committee of the American Railway Association last year a classification of freight loss and damage payments for the class 1 roads for the calendar year 1914 showed that $3,506,545, or 10.83 per cent, was due to defective equipment. Just how much of the 6 per cent charged to robbery, 6.47 per cent charged to wrecks, 13.4 per cent to rough handling of cars and 20.9 per cent to unlocated damage was also due to defective equipment, will never be known. In a series of five articles on Defective Box Cars and damaged Freight, which were published in the *Railway Age Gazette* in the early part of 1912, a thorough study was made of the defects which were responsible for loss and damage to freight, and constructive recommendations were made in all cases as to how these might be overcome. Undoubtedly the committee which is in charge of the design of a standard box car for the American Railway Association is also giving special attention to those features of design and construction that are responsible for loss and damage to the lading.

Use of Association Specifications

The Master Car Builders' and the Master Mechanics' Associations have a considerable number of well prepared specifications and the number is being added to each year. These specifications have been prepared by the expenditure of a great deal of time and energy by the members of the committees on Specifications and Tests of Materials and we believe they are the best specifications to be obtained. They represent the unanimous opinion of the committee members, as whenever there is a difference of opinion the matter is thoroughly thrashed out and the views are harmonized. The committees are appointed from year to year to conduct the work of preparing these specifications for the use of the members of the association; why then do not all of the members use them? With such specifications available it seems strange that anyone should not recognize their value and make use of them rather than of specifications which they themselves prepare or which are obtained from outside sources. To make use of the specifications is not only to encourage the committee by thus showing an appreciation of its work but it should be recognized that if specifications are worth the time and energy spent on them by the committee (and we thoroughly believe that they are) they should be used by every road that is a member of the association. This is a matter that should be brought home to all the members. It is a pretty poor policy to approve a specification when it is submitted to letter ballot and then use some other specification when ordering material.

Inadequate Reinforcement of Wooden Cars

Among the first steel freight equipment, designed and built before car designers were familiar with steel construction and its characteristics, there were many cars which were by no means strong enough to meet the service requirements expected of them. Experience with these cars led gradually to increased weight in cars of steel construction, this increase in weight being brought about by the use of heavier and consequently stronger parts. The poorly designed steel car is not yet entirely eliminated, but in general it may be said that designers have realized what is necessary in the construction of a steel car. But one of the worst trouble-makers the railroads now have to contend with is the wooden car with the so-called reinforced underframe which is supposed to place it on a par with steel construction as far as strength is concerned. It is not intended to include the properly reinforced wooden car in this category, but there are many of these so-termed reinforcements which are not reinforcements, but merely steel members addd to the wooden underframe in a more or less haphazard manner without adding to its strength. Some of these structures seem to be placed under cars without any calculation being made as to their strength or their adequacy as a means of increasing the life of the car. Devices of this nature are the greatest help in keeping the repair tracks filled, and any road that makes use of them is making trouble for itself and for the railroads of the country in general.

The A. R. E. E. on Lamp Rating

The Association of Railway Electrical Engineers, in its convention yesterday, decided to adopt the lumen as the basis for rating all incandescent lamps for train lighting; these are now rated in watts. As this is the first time that an organization of engineers has adopted this most logical and satisfactory basis of lamp rating, the Association of Railway Electrical Engineers is to be highly complimented on its progressive action. In this it becomes the leader in a movement to make the new rating universal. The principal advantage of the lumen rating over the watt rating is that it gives a direct indication of the total light output of a lamp instead of the watt or current consumption as is given by the watt rating. With the new rating the light flux will remain constant for any given lamp, regardless of improvements in its efficiency. For this reason, increased efficiency will effect a reduced current consumption per lamp, which means a reduction in the cost per light and, in train lighting, a reduced load on the battery. With the wattage rating such improvements simply meant more light for the same cost which, with a properly designed system of illumination, is neither necessary nor desirable.

BETTER MEN NEEDED IN THE CAR DEPARTMENT

ONE of the most perplexing problems confronting the car department is how to secure competent car repair foremen, car inspectors and M. C. B. billing clerks. Car department officers in many cases are likely to charge this practically entirely to the inadequate compensation for these positions, as compared with industrial and other fields with which they have to compete in securing men. Is this really the fundamental cause? Is it not rather that the car departments generally have given entirely too little attention to the question of developing and training such employees? Is it not true also that they have fallen down badly in publicity campaigns to attract desirable young men to enter the service? Is it not too often the case that men are hurriedly selected for these positions when vacancies occur, with little or no systematic preparation or training for the work which they are to undertake, and that much time and money is then lost in getting them to fill these positions with even a fair degree of satisfaction?

A few members of the Master Car Builders' Association have consistently advocated the necessity of adequate apprenticeship courses. Not only must such training be provided for in connection with more careful provisions for selecting suitable raw material, but an effort must be made to attract high school graduates to take advantage of this training. Such young men are often attracted to industrial or commercial pursuits because of the larger salaries offered at the start. Some of them make good in a decided fashion; others, and possibly the great majority, are lost sight of. The railroads usually give recognition to dependable men according to their qualifications and the prospect for early promotion is somewhat better because of less competition. There is lots of room for good, bright high school graduates in the car department. It is unfortunately true that the compensation is low; on the other hand, railroad executives are fast awakening to the inadequacy of the salaries paid for men employed in that work as compared with the responsibilities which they have to shoulder. They are fast beginning also to realize that greater efficiency will result and therefore much money will be saved, directly or indirectly, by securing competent men for this work. The possibilities are such that car department officers should start effective publicity campaigns to attract bright, capable young men and then see that they are properly and thoroughly trained acceptably to fill the exceedingly difficult and responsible positions mentioned above.

PROGRAM FOR TODAY AND SUNDAY

SATURDAY, JUNE 17

10.30 A. M.—*Orchestral Concert.* Entrance Hall. Million-Dollar Pier.

3.30 P. M.—*Baseball.* Master Car Builders vs. Master Mechanics. Inlet Park.

8.15 P. M.—*Theatre Party.* Million-Dollar Pier.

SUNDAY, JUNE 18

8.00 A. M.—*Golf Tournament.* Atlantic City Country Club.

3.30 P. M.—*Sacred Concert.* Parlors of Marlborough-Blenheim. Soloist: May Dearborn Schwab, New York.

WHO HAS LOST AN EYE GLASS?

A glass which was lost from somebody's eye-glasses has been found, and may be secured if the owner will call at the booth of the *Daily Railway Age Gazette.* It is in a perfect state of preservation.

THE NORTH WESTERN CLUB

All past and present employees of the Chicago & North Western and the Chicago, St. Paul, Minneapolis & Omaha attending the convention are urged to meet upon the porch of the Shelburne Hotel, Saturday at 12.30 P. M., for the annual luncheon. Come and meet your friends.

FORE!

Golfers will please register with the Golf Committee to-day for the tournament to-morrow at the Atlantic City Country Club. Players will be sent off from the first tee in foursomes and the advice is given to go out early and get started. The Golf Committee has secured a large number of entries for the event. The 18 holes may be played any time during the day, either morning or afternoon.

THEATRE PARTY

The vaudeville entertainment to-night at 8.15 o'clock in the Hippodrome promises to be a most interesting event. The program is as follows: Emmett Welch minstrels, the Brightons, Armstrong and Ford, Keno and Greene, Jarrow, Romanoff, Frank and Company.

Langley Ingraham is in charge of the committee, assisted by J. R. Forney, Don L. Clements, W. H. Bentley, W. T. Kyle, C. C. Farmer and A. G. Bancroft.

REGISTRATION FIGURES

The registration figures, as compiled from the official enrollment lists for the past five years, are most gratifying. There are more members of the M. C. B. and M. M. Associations registered than in any other year, as is shown by the accompanying table. This is also true of the special guests.

	1912	1913	1914	1915	1916
Members M. C. B. and M. M.	294	459	506	448	527
Special Guests	278	235	249	230	319
Railroad Ladies	238	289	237	233	264
Supply Ladies	186	256	234	188	254
Supply Men	1297	1405	1275	1037	1295
Totals	2293	2644	2501	2136	2659

There were fewer railroad ladies than in 1913 and about the same number of supply ladies as in that year. There were more supply men in 1913 and about the same number in 1912. The total registration is larger than any other year, although there are only 15 more this year than in 1913.

R. S. M. A. ELECTION DAY

The election of new members of the R. S. M. A. executive committee will be held between 10 a. m. and 12 o'clock noon to-day in the Executive Committee's room, next to the enrollment booth. The following members are to be elected: Two from the second district: New York and New Jersey; one from

the third district, Pennsylvania; one from the fourth district, Ohio, Indiana and Michigan; and one from the fifth district, Illinois, Iowa and Minnesota. The annual meeting and election of president and vice-president will be held in the Greek Temple, on the pier, at 12 o'clock.

RAILWAY ELECTRICAL ENGINEERS' CONVENTION

The semi-annual convention of the Association of Railway Electrical Engineers was held yesterday at the Hotel Dennis. The report of the Committee on Illumination is of special interest as this advocates a very important change in the rating of incandescent lamps from that of watts, or power input, to that of lumens, a measure of the actual light flux output of the lamp. Obviously this is a more logical method of rating lamps, as it defines the lamp in terms of light instead of in terms of power, as formerly.

The Association is to be congratulated for its progressive action in being the first to advocate a change of this character which is so important to the art of illumination. An important result of the adoption of the new basis of lamp rating will be that as further improvements in lamp manufacture increase the lamp efficiency, there will be a reduction of power consumed by the lamps instead of an increase in the light produced. The committee recommends that for some time at least the lamps be rated in both lumens and watts; this will be of material assistance in educating the public to the use of the lumen rating. On account of the manufacturing consideration involved, the committee recommends that the gas-filled lamps be rated in mean spherical candle power and that the vacuum type lamps be rated in watts; the idea being that the change to the lumen basis will be made as soon as possible. In discussing the lamp sizes proposed, Mr. Billau, chairman, stated that the present sizes of 20, 25 and 40-watt lamps, namely, 175, 250 and 500 lumen lamps, were very satisfactory for train lighting. He pointed out, however, that the 60-watt lamp gives an illumination somewhat too low and the 100-watt lamp gives an illumination somewhat too high for single lamp units. The committee has recommended a new lamp midway between these two which would develop a light flux of 1,000 lumens, requiring approximately 68 watts. The Pullman Company is using, at present, a new single lamp lighting fixture, employing a 100-watt gas-filled lamp, giving approximately 1,500 lumens. This, however, is experimental so far, and the officials in charge state that it is not entirely satisfactory but rather too large.

The report of the commitee was received and the secretary instructed to send this out to the various railroads for letter ballot.

Committee on Shop Practice.—The report of the Committee on Shop Practice was subdivided under the heads of compressed air, electric welding and maintenance and repairs. The report was largely an outline of data which will be obtained during the summer to be presented at the annual convention.

In discussing this report, C. H. Quinn, Norfolk & Western, pointed out the economy of butt-welding a small piece of tungsten high-speed tool steel on a piece of ordinary tool steel for use in lathe and similar work. Mr. Quinn also pointed out the importance of determining the amount of current per pound of metal applied for the various operations so as to compare the costs.

The report of the commitee was received and the committee continued.

The committee on anti-friction bearings for motor equipment reported the progress which has been made toward securing the co-operation of the Electric Power Club which represents all of the motor manufacturers in the country, with a view toward establishing proper bearing sizes for the various sizes and speeds of electric motors. This work will be carried on by a joint committee from the Electric Power Club, a committee of anti-friction bearing manufacturers' representatives, and the committee on anti-friction bearings of the Association of Railway Electrical Engineers.

The Committee on Crane Motor Standardization submitted an outline specification for crane motors. It is particularly desirable that some standardization along this line be effected so as to make it possible to insure quick repair of a failed crane or motor by keeping a few spare motors on hand. Chairman Meloy, New York Central Lines, stated that the committee had co-operated with the Electric Power Club committee on motor applications, and that negotiations had been started to interest the electrical engineers of the steel mills in the movement. The work of this committee will be carried on in the early future in joint committee meetings with a committee of the Electric Power Club, a committee from the Association of Steel and Iron Electrical Engineers, representatives of all of the crane manufacturers, and the Crane Motor committee of the Association of Railway Electrical Engineers.

The Committee on Data and Information reported that the customary information blanks are now being mailed to the proper railroad officials. Information will be requested this year on arc welding equipment, transformers, lifting magnets, magnetic chucks, etc., in addition to the usual information on car lighting, shop lighting and motor equipment.

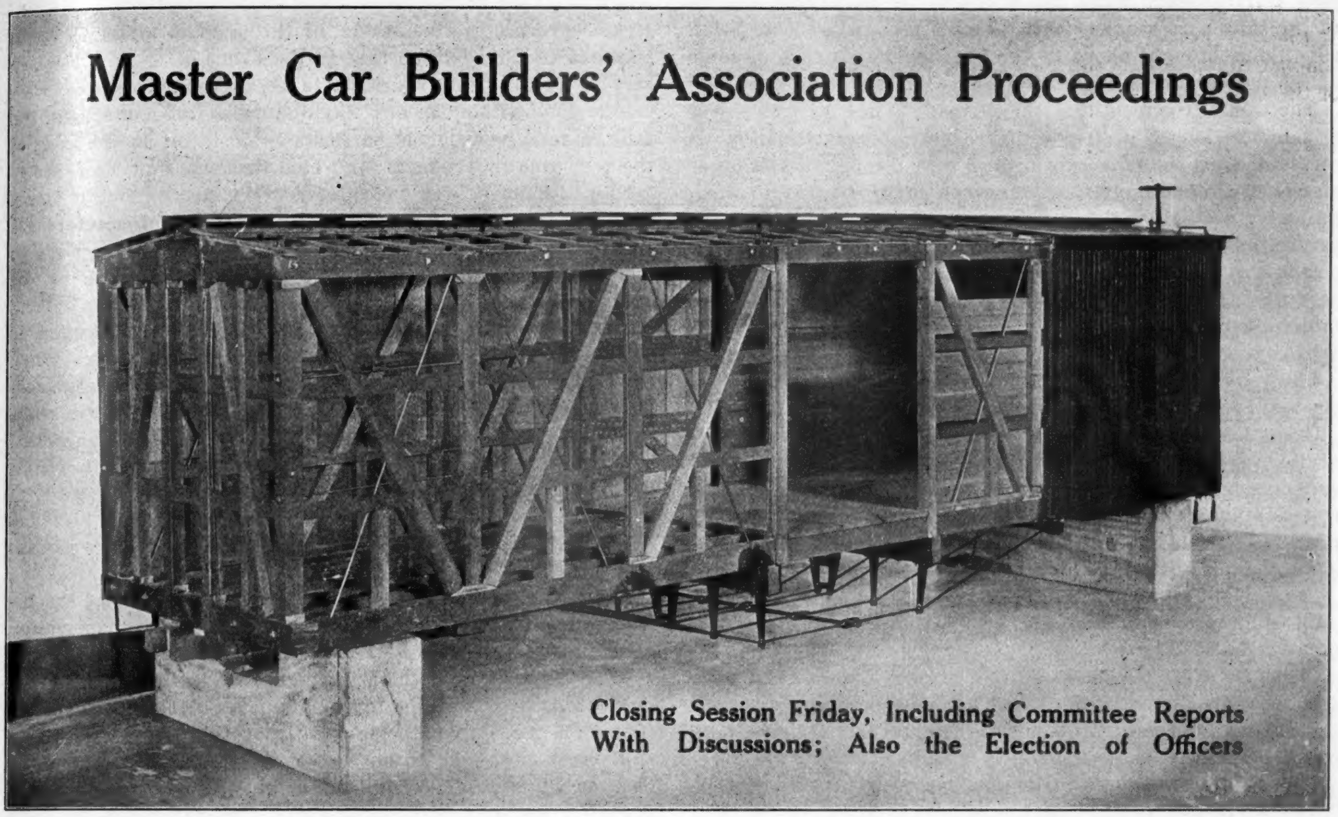
The report of the Committee on Train Lighting Equipment and Practices was very similar to the report of the Committee on Train Lighting of the M. C. B. Association. All of the members of the A. R. E. E. committee are members of the M. C. B. committee. The report of the committee was received.

A paper on Maintenance of Lead Storage Batteries in Car Lighting Service, by Ernest Lunn, chief electrician of the Pullman Company, was then presented. Mr. Lunn points out the great advantage of maintaining a uniform condition of train lighting battery cells. He states that whenever a battery is found to run consistenly low in voltage, individual cell readings should be taken. It will usually be found that one or two of the cells are defective, in which case these cells should be given special treatment, and if necessary be replaced. The former practice of taking simply gravity readings and a voltage reading as a check is hardly satisfactory, as the gravity depends on so many variable features, such as temperature, whether or not the battery has recently been flushed, etc.

Taking the individual cell readings of a battery is a simple matter and one which has been made use of for a long time, but Mr. Lunn points out that this should be done consistently and the individual cell readings carefully noted.

E. Wanamaker, electrical engineer of the Rock Island, read an interesting and instructive paper on "The Method of Cost Keeping for Railroad Shop Power." Mr. Wanamaker's paper was illustrated with skeleton forms for keeping record of costs and loads and a form showing an ideal distribution of railroad shop power cost. This subject is one of especial interest at this time when the railroads are doing everything possible to lower their operating costs. For this reason the discussion was general and was participated in by the electrical engineers present. Mr. Quinn, chief electrical engineer of the Norfolk & Western, emphasized the value of keeping such costs for power plant operation and had Mr. Wanamaker explain the system he uses on the Rock Island. Mr. Wanamaker described this system in detail and showed that to get the best results from the power plants it would be necessary that the officer in charge of their operation be equipped with suitable testing apparatus and that this apparatus be frequently used. He said that there was no question but what intelligent and competent supervision of many power plants on the various steam railroads would result in a saving of at least 40 per cent in operating expenses. He cited one example where the saving reached 60 per cent.

Master Car Builders' Association Proceedings



Closing Session Friday, Including Committee Reports With Discussions; Also the Election of Officers

Model of Box Car Built by New York Central Apprentices at East Buffalo

PRESIDENT MACBAIN called the Friday morning meeting to order at 9.35. The ballots were distributed and the following tellers were appointed: W. A. C. Henry, Penn. Lines; T. J. Burns, Mich. Cent., and T. H. Goodnow, C. & N. W., for counting the ballots for the officers; R. L. Kleine, Penn., and R. E. Smith, A. C. L., for the ballots for the Executive Committee; G. W. Rink, C. of N. J., and W. E. Dunham, C. & N. W., for the ballots for the Committee on Nominations, and B. P. Flory, N. Y. O. & W., and J. H. Manning, D. & H., for counting the ballots for Life Members.

Report of the Committee on Tank Cars

The first committee report on tank cars was presented at the 1903 convention. It directed general attention for the first time to the need for specially designed safety valves on cars handling volatile liquids and embodied specifications for the repair of old equipment and the construction of new equipment which were adopted as recommended practice. These specifications were modified in 1906 and 1907, and again in 1908. In 1910 they were advanced to standard. Since that time the rapidly increasing traffic in highly volatile products of the "Casinghead gasolene" variety has required further modifications and in order to avoid too frequent changes in the future the committee this year has rearranged the specifications and added to them two new classes of cars.

A. W. Gibbs, chief mechanical engineer, Pennsylvania Railroad, has been chairman of the tank car committee since its formation. The other members of the committee are C. E. Chambers, superintendent motive power, Central Railroad of New Jersey; Wm. Schlafge, general mechanical superintendent, Erie; M. J. McCarthy, superintendent motive power, Baltimore & Ohio South Western; Samuel Lynn, master car builder, Pittsburg & Lake Erie; Thos. Beaghen, Jr., master car builder, Union Tank Line, and O. J. Parks, superintendent equipment, German-American Car Lines.

THE Tank Car Committee made no report for the year 1915, largely for the reason that the 60-lb. test pressure prescribed by the Tank Car Specifications was before the Interstate Commerce Commission in the form of a complaint to restrain the railroads from enforcing the provision of the I. C. C. Regulations restricting the transportation of certain inflammable liquids to tank cars with tanks with tanks tested with a hydraulic pressure of 60 lb. per sq. in., as required by the Master Car Builders' Association.

The Commission, on February 18, 1916, decided that the rule was not unreasonable, and dismissed the complaint.

In the meanwhile had occurred the explosion and fire at Ardmore, Oklahoma, in connection with a tank car loaded with casinghead gasoline, which, while primarily due to a

man failure, emphasized the necessity of modifying certain of the tank care requirements to meet present transportation conditions, brought about by the growing importance of some of the new products offered for transportation in tank cars.

The committee feels that the increase in the unit of power and in the length of trains makes desirable a stiffening up of the designs for tank cars in line with the practice in other classes of freight equipment cars, such revision to be directed, however, rather to the requirements for cars built in the future than to those now in existence.

It is also felt that it is to the advantage of the buyer of tank cars that the specifications should fully and clearly state the minimum requirements of the Association, so that an intelligent comparison may be made of bids from car builders.

The committee has, therefore, divided tank cars into four classes, each with its own specification, namely:

CLASS I.—Tank cars built prior to 1903. The tank car specifications were originally formulated in 1903, and the Class I cars are principally wooden underframe cars, having tanks tested to but 40 lb. per sq. in., and therefore, under the I. C. C. Regulations can not be used for the transportatoin of inflammable liquids with flash points below 20 deg. F.

CLASS II.—Tank cars built since 1903. These cars have been built subject to the M. C. B. specifications requiring a test pressure of 60 lb. per sq. in.

CLASS III.—Tank cars for general purposes, to be built after a future date, to be fixed. From a transportation standpoint there is no difference between Class II and Class III cars, both being adapted to general use.

CLASS IV.—Tank car (insulated) for carrying highly volatile inflammable liquids, such as casinghead gasoline, to be built after the future date fixed.

Aside from the rearrangement of the specifications for Classes I and II cars in the form adopted for the new specifications, very little change has been made in these specifications covering existing cars. [Only the specifications for Classes III and IV are included here.—Editor.]

In the new specifications for Classes III and IV cars, requirements as to quality of materials, minimum thicknesses of plates, sizes and spacing of rivets, etc., have been prescribed. The specifications for materials are those adopted by the Association as Recommended Practice, which the committee feels should be followed wherever applicable.

The requirements for Classes III and IV cars have, as far as possible, been made the same, with a view to facilitating the conversion of a Class III car into a Class IV, if desired at any time.

The Class IV car takes the place of what has heretofore been classified as a "Special" tank car. While there has been a specification for this class of car, as a matter of fact very few special tank cars have so far been built. The prospect is, however, that in the near future there will be a considerable increase in the number of tank cars of this character.

In the case of the Class IV car, the requirements, including the test pressure, have been increased over those for the Class III car. This is not because the tank will be subjected to greater pressure, as, because of the setting of the safety valves, this will really be the same, but because the Class IV tank, by reason of the nature of its lading, is likely to be normally under pressure, and hence leaks must not develop in transit, as they would not only be difficult to stop under such conditions, but the ignition of the liquid might very rapidly develop pressure in the tank and blowing at the safety valves.

The committee has given careful consideration to the different features of tank car construction, among them being:

Safety Appliances.—With a view to greater uniformity than exists under the present rules, the committee recommends for Classes III and IV cars, requirements as to the location of running boards, grabirons, etc. In the case of the Class IV car, the committee believes that as far as possible the safety appliances, such as grabirons, ladders, and possibly running-board brackets, should be attached either directly to the metal jacket covering the insulation, or through the jacket to metal attached to the shell, so that in the event of its being necessary to repair penalty defects in these appliances, the work can be done without in any way disturbing the contents of the tank, a feature which is particularly desirable in the case of the very volatile products for which these cars are designed.

Facilities have been provided for getting up to the dome. This has been done for the reason that the car inspectors are required to inspect dome covers, etc., to see that they are in place, and also that men have to get up to the dome to test safety valves.

Safety Valves.—The Ardmore accident called attention to the necessity for a higher setting for the safety valves. When the rules for the safety valves were first drawn the only gasoline offered for transportation was that produced in the refinery. With this product the 8 and 12 lb. settings have answered very well, and there has been no evidence that weather conditions have caused blowing of the valves on cars loaded with it. With the advent of what is called casinghead gasoline (liquefied petroleum gas), which is a condensate from natural gas, the situation has materially changed.

Following the Ardmore accident, the regulations of the Interstate Commerce Commission governing the transportation of casinghead gasoline were changed by an order issued January 20, 1916, under which casinghead gasoline, blended or unblended, with a vapor tension not exceeding 10 lb. per sq. in. at 100 deg. F., may be shipped in ordinary tank cars of the 60-lb. test class, the safety valves of which must be set to open at a pressure of 25 lb. per sq. in., and provision must be made for automatically venting any pressure in the tank by starting the operation of removing the dome cover. The shipment of casinghead gasoline with a vapor tension over 10 lb. and not over 15 lb. per sq. in. is restricted by the Interstate Commerce Commission to insulated tank cars of a design approved by the Master Car Builders' Association.

At present the I. C. C. requirement is that casinghead gasoline with a vapor tension over 15 lb. can not be handled in tank cars, but must be shipped in drums. However, still lighter and more volatile grades of this gasoline are produced, and it is possible that with the increased demand for it for blending purposes, we may be asked to prescribe tank cars to be used for its transportation.

Upon the recommendation of the Tank Car Committee, the Association issued a circular specifying methods for meeting the requirements of the order of the Commission as to the 25-lb. setting of safety valves and the automatic venting of pressure, and this has also been included in all of the specifications.

The order of the Commission was effective May 15, 1916, as to cars for casinghead gasoline, and after January 1, 1917, applies to all tank cars for the shipment of inflammable liquids with flash points lower than 20 deg. F., the reason for this being that casinghead gasoline is largely used for blending with other gasolines having lower gravities, and seems to impart to them some of its own pressure characteristics.

While there is no necessity for the 25-lb. setting for safety valves on cars carrying products which do not come under the order of the Commission, there can be no objection to this setting in the case of less volatile products, and this setting has been used in the specifications for the Class III and Class IV cars. Some car owners are changing the valve springs on all their existing cars, so that such cars may be used for inflammable liquids with flash points lower than 20 deg. F. after January 1, 1917, if desired.

Location of Safety Valves.—It is sometimes difficult to obtain adequate dome capacity to provide for the expansion of the contents of the car, especially with liquids of the more volatile grades. It is therefore necessary that the full capacity of the dome shall be utilized, and to this end a design has been prepared for seating the safety valve directly on the

head of the dome, not interfering with the dome cover, and with the body of the valve extending inside the dome. No change has been made in the essentials of the valve. This location will tend to reduce the throwing of liquid gasoline from the valve, which has happened with the valve on the side of the dome, due to the opening leading from the dome to the valve becoming submerged.

Record of Test of Safety Valves.—The present specifications require that the record of the test of safety valves shall be stamped on the body of the valve, in addition to being stenciled on the tank. The purpose of this requirement is to identify the valve on the car with the test record on the tank, so that in case of accident there could be no question as to the valve on the car being the one that was tested. The committee now feels, however, that this requirement was a mistake, and that it is not desirable to require inspectors to climb to the top of the tank to inspect the stamping on the valve, particularly at night, as several fires have shown that the top of the tank is no place for flame lights. The committee therefore recommends the withdrawal of the requirement for stamping or otherwise marking the safety valves to show that they have been tested, the requirement that the record of the test of the valves shall be stenciled on the tank, to be retained.

Location of Running-boards.—The undesirability of having flame lights near the dome is also one of the reasons for preferring the low position of the running-board, another reason being that the low position makes it necessary for persons on the ground to stand sufficiently far away to prevent their being struck by the trucks.

Anchorage.—In the specifications for Classes III and IV cars, to be built in the future, the committee takes a positive stand against the use of head blocks for securing the tank against longitudinal shifting. The center anchorage—by which we mean the connection of the tank to the underframe at some point between the bolsters—has now been in use for twelve years, and has shown its superiority beyond any question. The principal advocates of the old head-block method are the shippers of acids. The committee has given careful hearing to a representative of this interest, and at his suggestion has sounded the concerns who use tank cars for acid shipments as to their experience with the different types of anchorage. While a few concerns are strong in their preference for the head blocks, others are equally positive in their opinion in favor of the center anchorage, and it is noticeable that those shippers who have both types of fastening in service prefer the center anchorage, and that, except in the cases of the few concerns referred to, the acid cars recently built are of the center anchorage type.

It is the conclusion of the committee that the opposition to this method of anchorage is based rather upon the fears of those who have never used anything but the old head-block type of anchorage, rather than upon any difficulties experienced by the users of the center anchorage method, and it is not considered that these supposed disadvantages are sufficient to outweigh the known defects of the head-block method.

The committee feels free to recommend the center anchorage method, as there are a number of designs which meet the requirements as to minimum strength, etc., given in the specifications.

Transferring Old Tanks from Wooden Underframes to Steel Underframes.—As the wooden underframes show their weakness, many tank car owners wish to transfer the old tank to a steel underframe. The committee feels that it is unwise to transfer to steel underframes tanks built prior to 1903 which will not stand the 60-lb. test pressure required in the case of tanks built since that time, and has included in the specifications the requirement that when such tanks are transferred they shall be secured against end shifting by some means other than by the use of head blocks.

Tanks Which Will Not Stand the 60-lb. Test Pressure.—The present specifications require that "After January 1, 1918, all tanks in transportation service shall be subjected to the full test requirements of 60 lb. per sq. in." This requirement has brought strong protest from many tank car owners. Some of them recognize the propriety of restricting such cars to certain classes of traffic; some voice a general protest against any restriction; and none mention any date on which any action in the matter shall be effective. This question has given the Tank Car Committee great concern. The committee has from the beginning been interested primarily in regulations from the standpoint of safety, but the fact can not be overlooked that cars carrying liquids must of necessity be in a different class and in better condition than those handling ordinary products. As stated in the decision of the Interstate Commerce Commission dismissing the complaint against the 60-lb. test for cars for inflammables:

"The real purpose of the interior pressure test is not . . . to insure that the tank will withstand an interior pressure of 60 lb. per sq. in. developed by expansion of the contents or the surging of the liquid when the car is in motion, but is largely to secure a degree of strength and firmness sufficient to withstand the inevitable shocks of ordinary transportation. The ultimate purpose of the test is to detect any weakness in the tank and to guard against dangers resulting from the use of those that may be unsubstantial."

The committee recognizes, however, that there are commodities which do not require the best class of tanks—commodities which are neither dangerous nor of great value; other commodities, while not dangerous, are expensinve, and any rupture of the tank would entail considerable loss. The committee is not prepared to recommend at this time any change in the requirement referred to, as the owners of the cars which will be affected have not furnished data to guide the committee in differentiating as to commodities that might safely be carried in tanks, which, while it is essential that they must be of substantial construction, will not meet more than a 40-lb. test pressure. The effective date of the requirement is now January 1, 1918, and before that date there will be another meeting of the Association. In the meantime the Tank Car Committee will make a careful investigation of the subject and be prepared to submit recommendations which will conserve the best interests of both the railroads and the tank car owners, and it is hoped that those tank car owners who now object to every proposition to improve the general condition of the tank car equipment, will offer some helpful suggestions.

Bottom Outlet Valve.—A standard design of bottom outlet valve is desirable from the standpoint of both the shippers and the railroads, and the committee has therefore included in the specifications for cars to be built requirements for the arrangement of the outlet. The thread connection, 5¼ in. diameter, four threads per in., is in pretty general use on existing cars. Provision has also been made for a 6-in. outlet pipe, where desired, with a reducer carrying the standard threaded end.

In these specifications, particularly those for cars to be built, the committee has endeavored to meet the criticism of tank car owners that changes in the specifications are too frequent, by making requirements that will provide a car which will meet satisfactorily the conditions for a reasonably long time to come.

CLASS III TANK CAR. (BUILT AFTER JANUARY 1, 1917)

TANK

1. The calcualted bursting pressure, based on the lowest tensile strength of the plate or casting and the efficiency of the seam or attachment, shall not be less than 300 lb. per sq. in.

2. MATERIAL.—(a) All plates for tank and dome shall be of steel complying with the American Society for Testing Materials Specifications for boiler plate steel, flange quality.

The use of material other than steel will be permitted where desirable because of the nature of the product to be transported; provided that the tank shall be subject to the same requirement as to bursting pressure, and that the thicknesses of the plates shall be increased to correspond to those speci-

fied in the case of steel, based upon the lowest tensile strength of the material, and be approved by the Master Car Builders' Association.

(b) Rivets shall comply with the Master Car Builders' Association specifications for rivet steel and rivets for passenger and freight equipment cars.

(c) Minimum thicknesses of plates shall be as follows:

Diameter of Tanks.	Bottom Sheet.	Shell Sheet.	Dome Sheet.	Tank Heads.	Dome Heads.
60 in. or under....	7/16 in.	¼ in.	5/16 in.	½ in.	5/16 in.
Over 60 in. to 78 in.	7/16 in.	5/16 in.	5/16 in.	½ in.	5/16 in.
Over 78 in. to 96 in.	½ in.	⅜ in.	5/16 in.	½ in.	5/16 in.

For tanks without underframes the minimum thickness of bottom sheet shall be ⅝ in.

For tanks built in rings the thickness specified for bottom sheet shall apply to the entire cylindrical shell.

For car with underframe the minimum width of bottom sheet of tank shall be 60 in., but in all cases the width shall be sufficient to bring the entire width of the longitudinal seam, including overlaps, above the cradle.

3. RIVETING.—(a) All seams shall be double riveted, with the exception of the dome head seam which may be single riveted.

Seams shall be riveted metal to metal, without the interposition of other material.

(b) For double riveting the size and pitch of rivets shall be as follows:

Thickness of Plate.	Diameter of Rivet.	Longitudinal Pitch.	Back Pitch.
¼ in.	⅝ in.	2½ to 2¾ in.	1½ to 1¾ in.
5/16 in.	⅝ in.	2½ to 2¾ in.	1½ to 1¾ in.
⅜ in.	¾ in.	2¾ to 3 in.	1¾ to 2 in.

The efficiency of the seam shall be not less than 70 per cent of the strength of the thinnest plate.

For single riveting the size and pitch of rivets shall be as follows:

Thickness of Plate.	Diameter of Rivet.	Pitch.
5/16 in.	⅝ in.	1¾ to 2 in.
⅜ in.	¾ in.	1⅞ to 2⅛ in.

(c) The extreme calking edge distance, measured from center line of rivet hole, shall not be less than one and one-

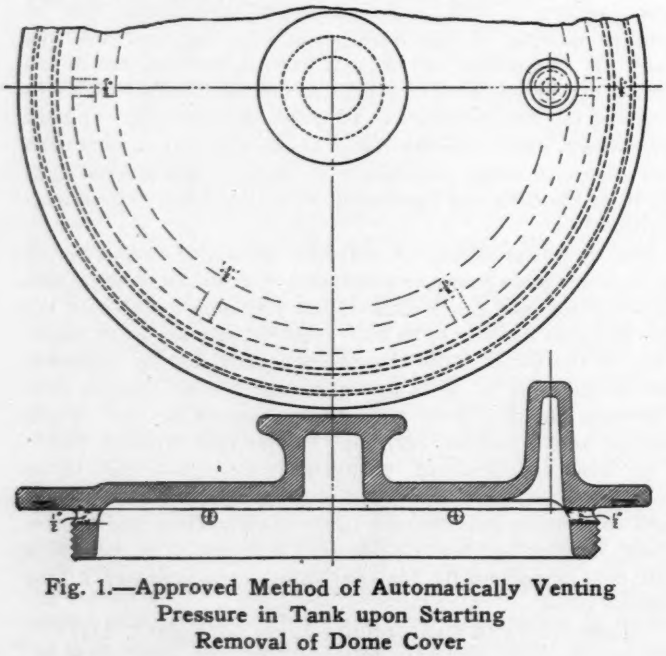


Fig. 1.—Approved Method of Automatically Venting Pressure in Tank upon Starting Removal of Dome Cover

half times the diameter of the hole, and not more than one and one-half times the diameter of the hole plus ⅛ in.

The angle of the calking edges shall be between 60 and 70 degrees with the flat surface of the plate.

4. CALKING.—Seams shall be calked both inside and outside. The purpose of the inside calking is to prevent access of contents of tank to the seams. Calking may be done by the electric welding process.

5. TANK HEADS.—Tank heads shall be dished to a radius of 10 ft. for pressure on concave side.

In the case of compartment cars each compartment shall have two heads, convex outward.

6. DOME.—(a) The tank shall have a dome with a minimum capacity, measured from the inside top of shell of tank to the top of dome, of not less than 2 per cent of the total capacity of the tank, that is, the shell and dome capacity combined.

(b) Dome head shall be of steel plate, or the dome head and ring in one casting may be of cast steel.

Dome ring and cover shall be of cast or pressed steel or of malleable iron.

If of steel plate, dome head shall be dished to a radius of 8 ft.

The opening in shell for dome shall not exceed 22 in. in the direction of the length of the tank by 28 in. across the tank.

(c) The dome cover shall be secured either by screw joint, or by bolting, or by yoke with center screw.

If screwed dome cover is used, the depth of flange shall not be less than 2½ in.

The joint of the dome cover shall be made tight against

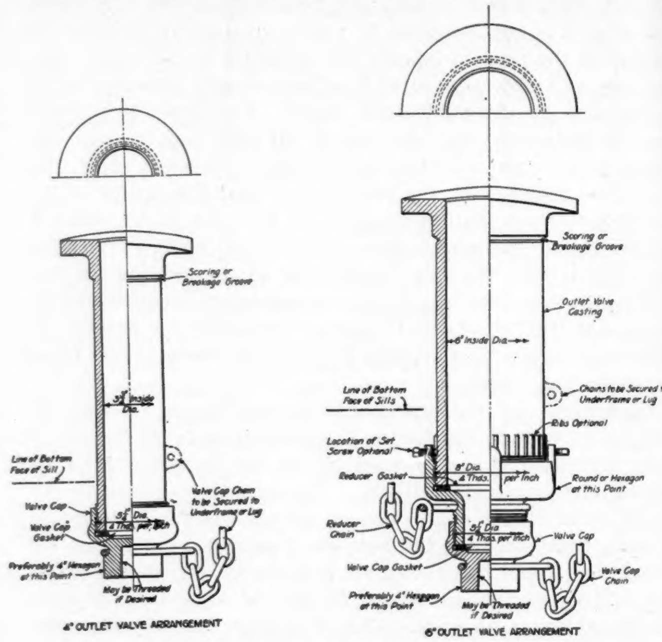


Fig. 2.—Arrangement of Bottom Outlet Valves

vapor pressure, and when necessary to secure this a satisfactory gasket shall be used.

For cars to be used for the transportation of inflammable liquids with flash points below 20 deg. F. the mechanical arrangement for closing the dome cover shall either be such as to make it practically impossible to remove the dome cover while the interior of the car is subjected to pressure, or suitable vents that will be opened automatically by starting the operation of removing the dome cover shall be provided. An approved method is shown by Fig. 1. Other methods may be used if approved by the Master Bar Builders' Association.

7. BOTTOM OUTLET VALVE.—(a) If tank is provided with bottom outlet valve, the outlet valve casting shall be so designed that breakage will not unseat the valve. The preferable construction is to have the outlet valve casting scored to confine the breakage at the scoring (Fig. 2).

The bottom of the main portion of the outlet valve casting, or some fixed attachment thereto, shall have external "V" threads 5¼ in. in diameter, and a pitch of four threads to the inch. Additional attachments thereto, having threads of other dimensions, may be used (Fig. 2).

Where a 6-in. bottom outlet valve is used, the bottom outlet valve casting shall be designed to have a diameter of 8 in. over threads, and a pitch of four threads to the inch, in addition to connections as above (Fig. 2).

Cars used for the transportation of acid or other corrosive substances, if fitted with bottom outlet valve castings, need not have threads as above, but may be designed for the use of a bolted cover, to insure a tight joint. A suitable gasket shall be used when necessary.

Bottom outlet valve castings when applied to tanks having center sills shall be of such length that the threaded end of the casting will project below the bottom face of the sills sufficiently to facilitate the application and removal of caps and other attachments.

All outlet valve casting caps and attachments shall be secured to the car to prevent loss.

(b) Where the tank is anchored rigidly to the underframe there shall be a longitudinal clearance of not less than 3 in.

on each side of the bottom outlet valve casting. Where the anchorage used provides for a limited longitudinal movement of the tank, there shall be a clearance of 3 in. on each side of the bottom outlet valve casting when the tank has reached the limit of longitudinal movement provided for by such anchorage. There shall be a transverse clearance of not less than ½ in. on each side of the bottom outlet valve casting.

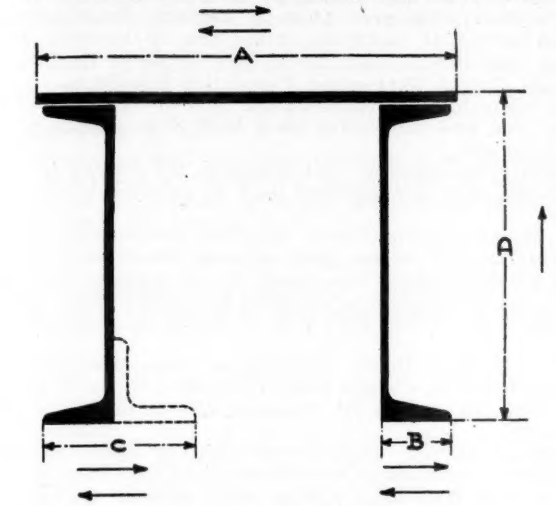


Fig. 3.—Direction in Which Buckling may take Place in Center Sill, Classes III and IV Tank Cars

(c) If bottom outlet valve is used, the handle shall be within the tank or dome.

UNDERFRAME, ANCHORAGE, ETC,

8. Tank cars may be built either with or without underframes.

9. CARS WITH UNDERFRAMES.—Material (a) Underframes shall be of steel which complies with the Master Car Builders' Association specifications for structural steel, steel plate and steel sheets for freight equipment cars.

(b) Rivets shall comply with the Master Car Builders' Association specifications for rivet steel and rivets for passenger and freight equipment cars.

(c) Underframes shall be equipped with cast or forged steel striking plates, center plates and draft lugs. Malleable iron may be used for other details, such as side bearings, push-pole pockets, etc. Steel and malleable iron castings shall comply with the Master Car Builders' Association specifications for these materials.

CENTER SILLS.—The center sill construction shall meet the following requirements:

Minimum center sill area between points of impact, 30 sq. in.

Ratio, stress to end load, not more than .05.

Length of center or draft sill members between braces shall not be more than twenty times the depth of the member, measured in the direction in which bucking may take place (Fig. 3).

Continuous sills having coverplates are preferable.

If other construction is used, the effective cross-sectional area, including connections, must be at least as strong as continuous sills.

(See Master Car Builders' Association Recommended Practice for Center Sills for New Cars, and report of Committee on Car Construction, page 489, 1914 Proceedings.)

10. CARS WITHOUT UNDERFRAMES.—Cars without underframes shall have shell reinforced in thickness as provided for in Sec. 2 (c).

11. BODY BOLSTERS.—Body bolsters shall be of steel castings or of the built-up type, thoroughly substantial, and sufficient in strength to take at least one-half the total weight of loaded tank car on each side bearing.

12. DRAFT GEAR.—Cars shall be equipped with a draft gear having a minimum capacity of 150,000 lb.

The strength value of the draft attachments and the center sill construction shall be equivalent to at least 12½ sq. in. of steel in tension and compression, 8 sq. in. of rivet bearing area and 15 sq. in. in shear. The ratio of unit stress to end load shall not exceed 0.12.

13. ANCHORAGE.—(a) Longitudinal. The tank shall be secured against end shifting by anchorage at the center, or at the bolster, or be secured to the underframe by some means other than by the use of head blocks. The method of anchorage shall be one approved by the Master Car Builders' Association.

The longitudinal anchorage of tank to underframe shall be

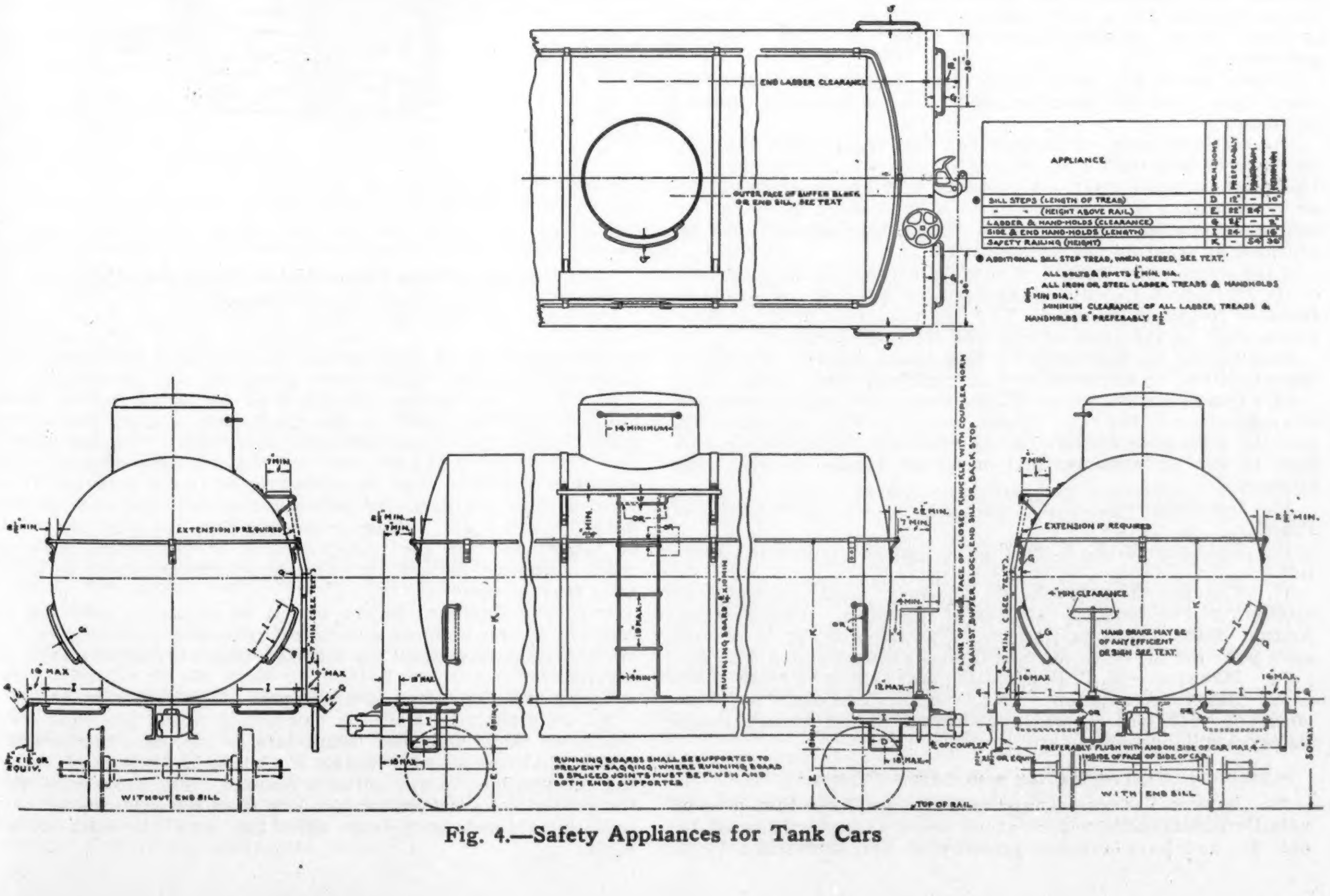


Fig. 4.—Safety Appliances for Tank Cars

of metal throughout, and the minimum requirements shall be as follows:

Connection of anchorage to tank:	
Shearing area of rivets	30 sq. in.
Bearing area of rivets	24 sq. in.
Connection of anchorage to frame:	
Shearing area of rivets or bolts	15 sq. in.
Bearing area of rivets or bolts	12 sq. in.

When bolts are used for securing the anchorage rigidly to the underframe, they shall be turned bolts driven in reamed holes.

Where either tank or underframe has more than one connection, if these connections hold the tank rigidly to the underframe, the total rivet or bolt value shall be 20 per cent in excess of the requirements specified; if the connections do not

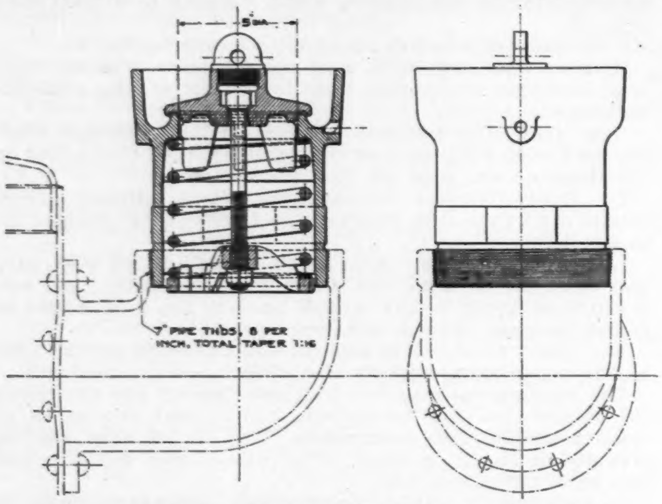


Fig. 5.—Five-Inch Safety Valve, Standard, Applied to Side of Dome

hold the tank rigidly to the underframe, the total rivet or bolt value shall be double that specified.

(b) DOME YOKES, TANK BANDS, ETC.—The tank shall be secured from turning on the underframe either by an anchorage or by dome yokes, and shall also be secured to underframe by tank bands, or other approved means of equal strength and security.

If tank bands are used, there shall be two for tanks not more than 78 in. in diameter, and four for tanks of greater diameter.

The sectional area of dome yokes and tank bands shall at no place be less than 1 sq. in., or 1⅛ in. round iron upset to 1⅜ in. at threaded ends. A threaded end 1⅜ in. in diameter or more, with a body consisting of a flat band 2 by ½ in., or equivalent section, or round iron 1⅛ in. in diameter, will be accepted as meeting the requirements.

If the dome yoke is used, it may be a rod 1 in. in diameter, or its equivalent, to which is secured the band or rod which is fastened to the underframe. The sectional area of dome yoke bands shall be the same as required for tank bands.

Cars having no underframes, with tanks securely riveted to body bolsters, do not require dome yokes or tank bands.

14. PUSH-POLE POCKETS.—There shall be a push-pole pocket at each corner of the car. Where, from the construction of the car, the push-pole pockets can not well be placed on the corners of the underframe, they shall be applied to the body bolsters.

15. COUPLERS.—M. C. B. Standards and Recommended Practice.

16. BRAKES.—M. C. B. Standards and Recommended Practice.

17. TRUCKS.—The truck as a whole shall be equal in strength to the carrying capacity of the axles. Wheels, axles, journal boxes, bearings, and center plates shall be in accordance with the M. C. B. Standards and Recommended Practice.

18. MARKING.—M. C. B. Standard Marking for Freight Cars.

19. SAFETY APPLIANCES.—Safety appliances shall be in accordance with Fig. 4, which conforms to the United States Safety Appliances, Standard.

SAFETY VALVES AND SAFETY VENTS

20. SAFETY VALVES.—Tanks carrying products that give off volatile inflammable vapors at or below a temperature of 150 deg. F., and have a vapor pressure of not more than 10 lb. per sq. in. at a temperature of 100 deg. F., shall be equipped with 5-in. safety valves of approved design (Figs. 5 and 6), which shall be set to open at a pressure of 25 lb. per sq. in., a tolerance of 1 lb. above or below this pressure being allowed.

NOTE.—Typical inflammable or combustible liquid products of this description are: Alcohol, Acetone, Benzine, Benzol, Carbon Bisulphide, Distillates, Ether, Gas Oil, Gasoline, Hydrocarbon (gas drips), Illuminating Oil, Kerosene, Naphtha, Refined Oil, Toluol, Turpentine, Turpentine Substitute.

One valve shall be provided for a tank of a capacity of 6,500 gal. or less, and two valves for a tank of a capacity of more than 6,500 gal.

Where tanks carrying such products are divided into compartments, each compartment shall be provided with a safety valve.

21. SAFETY VENT.—Tanks carrying non-volatile products or products that do not give off inflammable vapors at or below 150 deg. F. (see Note) need not be equipped with safety valves, but if not so equipped, shall be provided with one open vent equal to not less than 2 in. in diameter, of approved design.

NOTE.—Typical liquid products of this description are: Calcium Chloride, Caustic Soda, Cottonseed Oil, Fish Oil, Glucose, Lard Oil, Linseed Oil, Molasses, Silicate of Soda, Tannery Products.

Provided, that to avoid evaporation or splashing of the liquid, or contamination by moisture, the vent may be closed with a frangible disk of lead or other suitable material, of a thickness that will insure rupture at a pressure not higher than 30 lb. per sq. in.

TESTS

22. CERTIFICATION OF TESTS.—Tests of all tanks and their safety valves shall be certified by the party making the tests

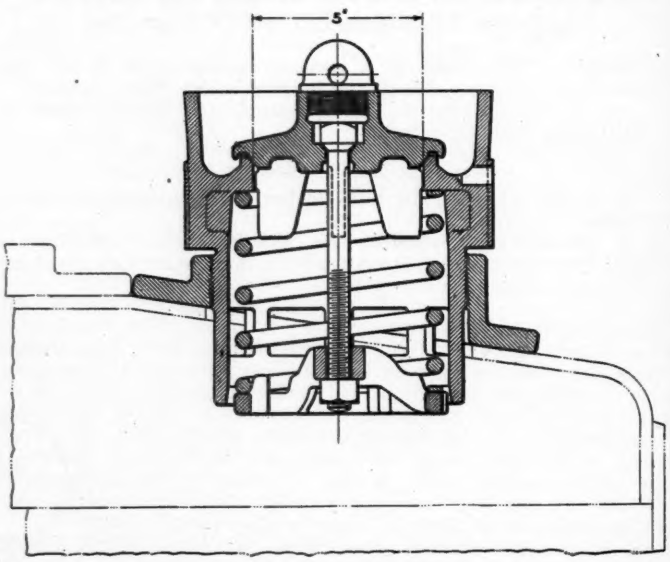


Fig. 6.—Five-Inch Safety Valve, Standard, Applied to Top of Dome

to the owner of the tank car and to the Chief Inspector, Bureau of Explosives, in the form prescribed by the Bureau.

23. TESTS OF TANKS.—Tanks shall be tested before being put into service, again at the expiration of ten years, and after that at intervals of not over five years; with the exception that where tanks are used for the transportation of such corrosive products that deterioration is to be expected in a shorter time, the first test period for such tanks shall be reduced to five years. Tanks requiring this five-year test shall be those used for the transportation of chemicals, such as acids, ammonia liquors, etc., and such other products as hereafter may be specified.

Any tank damaged to the extent of requiring patching or renewal of one or more sheets, or extensive reriveting or recalking of seams, shall be retested before being returned to service.

Tanks shall be tested to a pressure of 60 lb. per sq. in.

All tests shall be made by completely filling the tank with water, or other approved liquid safe to use, of a temperature which shall not exceed 70 deg. F. during the test, and applying the pressure in any suitable manner. The tank shall hold the prescribed pressure for not less than ten minutes without leak or evidence of distress after the tank has been calked tight.

When tanks are tested, the date, pressure to which tested, place where test was made, and by whom, shall be stenciled on the tank in accordance with the Master Car Builders' Standard Marking for Freight Cars.

24. Tests of Safety Valves.—Safety valves shall be tested at intervals of not over two years, those on new cars to be tested before the cars are placed in service.

The test may be made without the removal of the valve from the car, provided the valve unseats at a total pressure corresponding with the area of the seat multiplied by the required pressure (Fig. 7).

When valves are tested, the date, pressure to which tested, place where test was made, and by whom, shall be stenciled on the tank in accordance with the Master Car Builders' Standard Marking for Freight Cars.

Inspection

25. Inspection.—Tank cars shall be inspected as to their construction and equipment before being placed in service, by inspectors in the employ of the car builder or the car owner.

If the car is built from the design of the car builder, the car builder shall furnish the car owner a certificate that such car complies in all details with the Master Car Builders' Standard Specification for Class III Tank Cars.

When the car and its equipment meet the requirements of the Specification, the legend "M. C. B. Construction," with the initials of the party whose inspectors made the inspection, and the date of the inspection, shall be stenciled on the tank in accordance with the Master Car Builders' Standard Marking for Freight Cars.

Specification for Class IV Tank Car. (Built after January 1, 1917)

Designs for this class of car must be submitted to and approved by the Master Car Builders' Association.

Tank

1. The calculated bursting pressure, based on the lowest tensile strength of the plate or casting and the efficiency of the seam or attachment, shall be not less than 300 lb. per sq. in.

2. Material.—(a) All plates for tank and dome shall be of steel complying with the American Society for Testing Materials specifications for boiler plate steel, flange quality.

(b) Rivets shall comply with the Master Car Builders' Association specifications for boiler rivet steel and rivets for passenger and freight equipment cars.

(c) Minimum thicknesses of plates shall be as follows:

Diameter of Tanks.	Bottom Sheet.	Shell Sheet.	Dome Sheet.	Tank Heads.	Dome Heads.
60 in. or under....	7/16 in.	¼ in.	5/16 in.	½ in.	5/16 in.
Over 60 in. to 78 in.	7/16 in.	5/16 in.	5/16 in.	½ in.	5/16 in.
Over 78 in. to 96 in.	½ in.	⅜ in.	5/16 in.	½ in.	5/16 in.

For tanks without underframes the minimum thickness of bottom sheet shall be ⅝ in.

For tanks built in rings the thickness specified for bottom sheet shall apply to the entire cylindrical shell.

For car with underframe the minimum width of bottom sheet of tank shall be 60 in., but in all cases the width shall be sufficient to bring the entire width of the longitudinal seam, including overlaps, above the cradle.

3. Riveting.—(a) All seams shall be double riveted, with the exception of the dome head seam which may be single riveted.

Seams shall be riveted metal to metal without the interposition of other material.

(b) For double riveting the size and pitch of rivets shall be as follows:

Thickness of Plate.	Diameter of Rivet.	Longitudinal Pitch.	Back Pitch.
¼ in.	⅝ in.	2½ to 2¾ in.	1½ to 1¾ in.
5/16 in.	⅝ in.	2½ to 2¾ in.	1½ to 1¾ in.
⅜ in.	¾ in.	2¼ to 3 in.	1¾ to 2 in.

The efficiency of the seam shall be not less than 70 per cent of the strength of the thinnest plate.

For single riveting the size and pitch of rivets shall be as follows:

Thickness of Plate.	Diameter of Rivet.	Pitch.
5/16 in.	⅝ in.	1¾ to 2 in.
⅜ in.	¾ in.	1⅞ to 2⅛ in.

(c) The extreme calking edge distance, measured from center line of rivet holes, shall not be less than one and one-half times the diameter of the hole, and not more than one and one-half times the diameter of the hole plus ⅛ in.

The angle of the calking edges shall be between 60 and 70 degrees with the flat surface of the plate.

4. Calking.—Seams shall be calked both inside and outside. The purpose of the inside calking is to prevent access of contents of tank to the seams. Calking may be done by the electric welding process.

5. Tank Heads.—Tank heads shall be dished to a radius of 10 ft., for pressure on concave side.

In the case of compartment cars each compartment shall have two heads, convex outward.

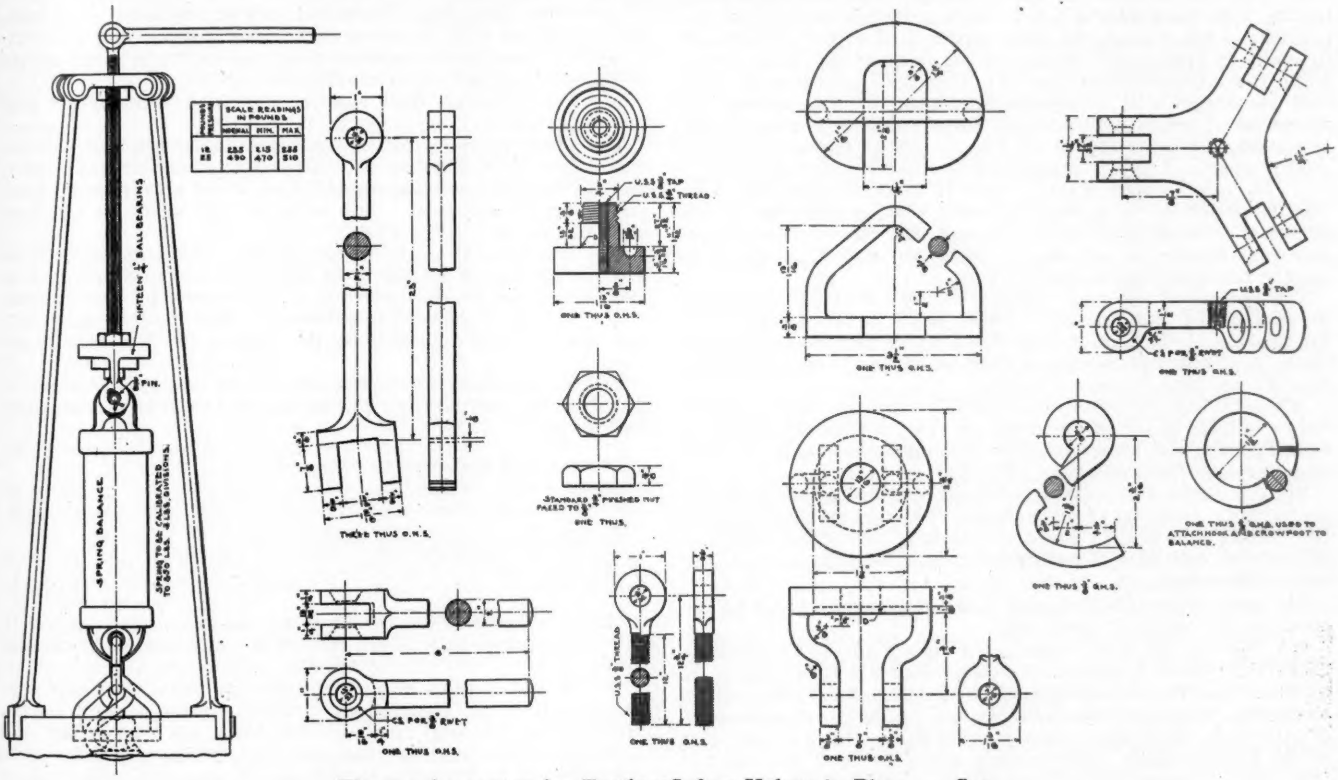


Fig. 7.—Apparatus for Testing Safety Valves in Place on Car

6. Dome.—(a) The tank shall have a dome with a minimum capacity, measured from the inside top of shell of tank to the top of dome, of not less than two per cent of the total capacity of the tank, that is, the shell and dome capacity combined.

(b) Dome head shall be of steel plate, or the dome head and ring in one casting may be of cast steel.

Dome ring and cover shall be of cast or pressed steel or of malleable iron.

If of steel plate, dome head shall be dished to a radius of 8 ft.

The opening in shell for dome shall not exceed 22 in. in the direction of the length of the tank by 28 in. across the tank.

(c) Dome cover shall be secured either by screw joint, or by bolting, or by yoke with center screw.

If screwed dome cover is used, the depth of flange shall not be less than 2½ in.

The joint of the dome cover shall be made tight against vapor pressure, and when necessary to secure this a satisfactory gasket shall be used.

For cars to be used for the transportation of inflammable liquids with flash points below 20 deg. F. the mechanical arrangement for closing the dome cover shall either be such as to make it practically impossible to remove the dome cover while the interior of the car is subjected to pressure, or suitable vents that will be opened automatically by starting the operation of removing the dome cover shall be provided. An approved method is shown by Fig. 1. Other methods may be used if approved by the Master Car Builders' Association.

7. Bottom Outlet Valve.—(a) If tank is provided with bottom outlet valve, the outlet valve casting shall be so designed that breakage will not unseat the valve. The preferable construction is to have the outlet valve casting scored to confine the breakage at the scoring.

The bottom of the main portion of the outlet valve casting, or some fixed attachment thereto, shall have external "V" threads 5¼ in. in diameter, and a pitch of four threads to the inch. Additional attachments thereto, having threads of other dimensions, may be used (Fig. 2).

Where a 6-in. bottom outlet valve is used the bottom outlet valve casting shall be designed to have a diameter of 8 in. over threads, and a pitch of four threads to the inch, in addition to connections as above (Fig. 2).

Bottom outlet valve castings, when applied to tanks having center sills, shall be of such length that the threaded end of the casting will project below the bottom face of the sills sufficiently to facilitate the application and removal of caps and other attachments.

All outlet valve casting caps and attachments shall be secured to the car to prevent loss.

(b) Where the tank is anchored rigidly to the underframe there shall be a longitudinal clearance of not less than 3 in. on each side of the bottom outlet valve casting. Where the anchorage used provides for a limited longitudinal movement of the tank, there shall be a clearance of 3 in. on each side of the bottom outlet valve casting when the tank has reached the limit of longitudinal movement provided for by such anchorage. There shall be a transverse clearance of not less than ½ in. on each side of the bottom outlet valve casting.

(c) If bottom outlet valve is used the handle shall be within the tank or dome.

7-A. Lagging.—The barrel, ends, and dome of tank, with the exception of the seating of the tank on the bolster and the seating of the pads of the fixtures, shall be lagged with 85 per cent carbonate of magnesia; or compressed cork board properly molded to fit; or hair felt, felted in sections and covered with a coating not soluble in gasoline; or other approved equivalent. The lagging shall have a thickness of 2 in., and the whole shall be covered with a jacket of metal ⅛ in. in thickness. Tank shall be well painted before being lagged and inside of jacket shall be painted before it is applied, with paint not affected by gasoline. Openings through the lagging shall be flashed around projections to prevent admission of water.

Underframe, Anchorage, Etc.

8. Tank cars may be built either with or without underframes.

9. Cars with Underframes.—Material. (a) Underframes shall be of steel which complies with the Master Car Builders' Association specifications for structural steel, steel plate and steel sheets for freight equipment cars.

(b) Rivets shall comply with the Master Car Builders' Association specifications for rivet steel and rivets for passenger and freight equipment cars.

(c) Underframes shall be equipped with cast or forged steel striking plates, center plates, and draft lugs. Malleable iron may be used for other details, such as side bearings, push-pole pockets, etc. Steel and malleable iron castings shall comply with the Master Car Builders' Association specifications for these materials.

Center Sills.—The center sill construction shall meet the following requirements:

Minimum center sill area between points of impact, 30 sq. in.

Ratio, stress to end load, not more than .05.

Length of center or draft sill members between braces shall not be more than 20 times the depth of the member, measured in the direction in which buckling may take place (Fig. 3).

Continuous sills having cover plates are preferable.

If other construction is used, the effective cross-sectional area, including connections, must be at least as strong as continuous sills.

(See Master Car Builders' Association Recommended Practice for center sills for new cars. Also report of Committee on Car Construction, page 489, 1914 Proceedings.)

10. Cars without Underframes.—Cars without underframes shall have shell reinforced in thickness as provided for in Section 2 (c).

11. Body Bolsters.—Body bolsters shall be of steel castings or of the built-up type, thoroughly substantial, and sufficient in strength to take at least one-half the total weight of loaded tank car on each side bearing.

12. Draft Gear.—Cars shall be equipped with a draft gear having a minimum capacity of 150,000 lb.

The strength value of the draft attachment and the center sill construction shall be equivalent to at least 12½ sq. in. of steel in tension and compression, 8 sq. in. of rivet bearing area, and 15 sq. in. in shear. The ratio of unit stress to end load shall not exceed 0.12.

13. Anchorage.—(a) Longitudinal. The tank shall be secured against end shifting by anchorage at the center, or at the bolster, or be secured to the underframe by some means other than by the use of head blocks. The method of anchorage shall be one approved by the Master Car Builders' Association.

The longitudinal anchorage of tank to underframe shall be of metal throughout, and the minimum requirements shall be as follows:

Connection of anchorage to tank:	
Shearing area of rivets	30 sq. in.
Bearing area of rivets	24 sq. in.
Connection of anchorage to frame:	
Shearing area of rivets or bolts	15 sq. in.
Bearing area of rivets or bolts	12 sq. in.

When bolts are used for securing the anchorage rigidly to the underframe, they shall be turned bolts driven in reamed holes.

Where either tank or underframe has more than one connection, if these connections hold the tank rigidly to the underframe, the total rivets or bolt value shall be 20 per cent in excess of the requirements specified; if the connections do not hold the tank rigidly to the underframe, the total rivet or bolt value shall be double that specified.

(b) Dome Yokes, Tank Bands, Etc.—The tank shall be secured from turning on the underframe either by an anchorage or by dome yokes, and shall also be secured to underframe by tank bands, or other approved means of equal strength and security.

If tank bands are used, there shall be two for tanks not more than 78 in. in diameter, and four for tanks of greater diameter.

The sectional area of dome yokes and tank bands shall at no place be less than 1 sq. in., or 1⅛ in. round iron upset to 1⅜ in. at threaded end. A threaded end 1⅜ in. in diameter or more, with a body consisting of a flat band 2 by ½ in., or equivalent section, or round iron 1⅛ in. diameter, will be accepted as meeting the requirements.

If the dome yoke is used, it may be a rod 1 in. in diameter, or its equivalent, to which is secured the band or rod which is fastened to the underframe. The sectional area of dome yoke bands shall be the same as required for tank bands.

Cars having no underframe, with tank securely riveted to body bolsters, do not require dome yokes or tank bands.

14. Push-pole Pockets.—There shall be a push-pole pocket at each corner of the car. Where, from the construction of the car, the push-pole pockets can not well be placed on the corner of the underframe, they shall be applied to the body bolsters.

15. Couplers.—M. C. B. Standards and Recommended Practice.

16. Brakes.—M. C. B. Standards and Recommended Practice.

17. Trucks.—The truck as a whole shall be equal in strength to the carrying capacity of axles. Wheels, axles,

journal boxes, bearings and center plates shall be in accordance with M. C. B. Standards and Recommended Practice.

18. MARKING.—M. C. B. Standard Marking for Freight Cars.

19. SAFETY APPLIANCES.—Safety Appliances shall be in accordance with Fig. 4, which conforms to the United States Safety Appliances, Standard.

SAFETY VALVES AND SAFETY VENTS

20. SAFETY VALVES.—Tanks shall be equipped with 5-in. safety valves of approved design, Fig. 6, which shall be set to open at a pressure of 25 lb. per sq. in., a tolerance of one lb. above or below this pressure being allowed.

One valve shall be provided for a tank of a capacity of 6500 gal. or less, and two valves for a tank of a capacity of more than 6500 gal.

Where tanks are divided into compartments, each compartment shall be provided with a safety valve.

21. SAFETY VENT.—Not used with this class of car.

TESTS

22. CERTIFICATION OF TESTS.—Tests of all tank cars and their safety valves shall be certified by the party making the tests to the owner of the tank car and to the Chief Inspector, Bureau of Explosives, in the form prescribed by the Bureau.

23. TESTS OF TANKS.—Tanks shall be tested before being put into service, and after that at intervals of not over five years.

Any tank damaged to the extent of requiring patching or renewal of one or more sheets, or extensive reriveting or recalking of seams, shall be retested before being returned to service.

Tanks shall be tested to a pressure of 75 lbs. per sq. in.

All tests shall be made by completely filling the tank with water of a temperature which shall not exceed 70 deg. F. during the test, and applying the pressure in any suitable manner. The tank shall hold the prescribed pressure for not less than ten minutes without leak or evidence of distress after the tank has been calked tight.

When tanks are tested, the date, pressure to which tested, place where test was made, and by whom, shall be stenciled on the tank in accordance with the Master Car Builders' Standard Marking for Freight Cars.

24. TESTS OF SAFETY VALVES.—Safety valves shall be tested at intervals of not over six months, those on new cars to be tested before the cars are placed in service.

The test may be made without the removal of the valve from the car, provided the valve unseats at a total pressure corresponding with the area of the seat multiplied by the required pressure (Fig. 7).

When valves are tested, the date, pressure to which tested, place where test was made, and by whom, shall be stenciled on the tank in accordance with the Master Car Builders' Standard Marking for Freight Cars.

INSPECTION

25. INSPECTION.—Tank cars shall be inspected as to their construction and equipment before being placed in service, by inspectors in the employ of the car builder or the car owner.

If the car is built from the design of the car builder, the car builder shall furnish the car owner a certificate that such car complies in all details with the Master Car Builders' Standard Specifications for Class IV Tank Cars.

When the car and its equipment meet the requirements of the Specifications, the legend "M. C. B. Construction," with the initials of the party whose inspectors made the inspection, and the date of the inspection, shall be stenciled on the tank in accordance with the Master Car Builders' Standard Marking for Freight Cars.

SAFETY APPLIANCES FOR TANK CARS BUILT AFTER JANUARY 1, 1917

All tank cars built after January 1, 1917, or old tanks placed on new steel underframes after that date must be equipped with safety appliances in accordance with Fig. 4. This arrangement conforms to the United States Safety Appliances Standard.

Tanks Covered with Jackets.—On tanks covered with jackets, metal pads should be attached to the shell proper with studs or rivets, to which brackets should be fastened for securing the safety appliances attached to the tanks; or, the safety appliances (with the exception of the running-board brackets and dome-platform brackets) may be secured to the jackets reinforced with metal pads at point of attachment, which pads must extend at least two in. from center line of rivet holes. The running-board brackets must be attached preferably to the underframe or to metal pads attached to shell proper. The dome platform brackets must be attached to tank bands or to metal pads attached to shell proper. When the safety appliances are attached to the jacket covering of the tank the jacket must be tightened so that there will be no danger of its slipping around.

DISCUSSION

W. H. V. Rosing, (St. L. & S. F.): There has been considerable controversy during the past year or two between railroads and oil companies in the Southwestern territory, principally in the State of Oklahoma, with reference to tank car construction for the transportation of crude oil and fuel oils, called the crude petroleum and fuel oils. In fact, there is also a difference of opinion among some of the railroads on this point. The oil companies have claimed that these liquids have a fire test of 300 deg. or higher, according to the present rules and regulations, and that they can be transported in cars having a 2 in. vent and without safety valves. A recent activity in the oil trade has caused both railroads and oil companies to lease tank cars, many of them not equipped with safety valves.

The St. Louis & San Francisco road does a large business in this trade and deals with many oil companies on its own rails as well as with connecting lines. We also use a great deal of fuel oil for shop and other purposes, and for the satisfactory performance of this material we are obliged to use an oil having a 170 deg. fire test. This oil will flash between 142 deg. and 145 deg. F. In fact, we sometimes receive fuel oils that will flash as low as 150 deg. fire test. It is my personal view that these oils should be shipped in tank cars equipped with safety valves, because they give off volatile inflammable vapors at or below 150 deg. It would be a source of much relief to us to know just the kind of tank car required for transporting crude petroleum and pure oil, and I would like to ask the committee to include the names of the two liquids referred to in the note under paragraph B, of Article 20, providing it finds this to accord with the requirements of the Association and the regulations of the Bureau of Explosives.

T. J. Burns, (Mich. Cent.): I want to propose the elimination or omission from the tank reservoir of the bottom discharge valve. The object of putting the bottom discharge valve in the tank cars is to permit of the unloading of the contents of the car by gravity. The methods, however, in use throughout the country seem to be changing. Some refiners pump out through the manhole, and some refiners fill through the manhole, and the bottom discharge valve gradually gets out of order. Little attention is paid to it, and in a way it may become a menace. In the last three months we have had two bad accidents. Over in Detroit a tank car of gasoline that had been running between the refiner and some unloading points, and on which top method of unloading had been used for some time, was unloaded by the gravity method on the siding in the yard. About 8,000 gallons of gasoline got away, and about nine o'clock that night some three miles of pavement blew up and about three million dollars' worth of property was damaged, as well as personal injuries. We thought that might be merely a chance accident, but later in our shops, where we use the gravity system of unloading, we had the same trouble. Of course, had some experienced person been on hand they might have stopped that leak, but that will not always be the case. In the case of the big property damage, first mentioned, the people in the yard were well accustomed to handling discharge valves and handling tank mechanism. When they could not control the situation they called the Fire Department. They could not control it and they called the Board of Public Works and the City Water Inspector; all the experts were there, but notwithstanding that fact the accident happened.

W. S. Topping: That matter is now before the Bureau of Explosives for consideration and within the next month or so we will probably be able to submit some recommendation to the Tank Car Committee.

G. M. Crownover, (C. G. W.): In support of the remarks just made I would say that we have on our road an experience with the discharge valve or pipe. The accumulation of ice in the bottom of the discharge pipe pushed the cap off and in thawing out on a warm day in the spring it commenced to leak on the road. It came into the yard and was hustled to the shop for repairs. Just about that time the men were coming to work, throwing their cigars on the ground before they went into the building, and it was a good scramble on our part to keep from having a disastrous fire, or some situation of that kind.

P. W. Helwig (C. & A.): Only just recently we lost a whole car of gasolene on account of a discharge valve becoming unseated. We had no bad accident, however. We lost a part of another car within the last 15 days. It would be a fine thing if this discharge valve might be eliminated.

R. E. Smith (A. C. L.): I think the work done by this committee has been most excellent and deserves the full appreciation and the thanks of this association. I move that this report be accepted and referred to letter ballot for adoption in lieu of the present specifications.

The President: We have with us this morning some gentlemen representing the Western Petroleum Refiners' Association.

Mr. Gibbs: I move that those gentlemen be given the privilege of the floor.

(The motion was carried.)

John McE. Ames (Western Petroleum Refiners' Assn.): At a recent meeting of the Western Petroleum Refiners' Association, the secretary, H. G. James, and the speaker were delegated to appear before you at this Convention in an appeal for certain changes in your proposed tank car specifications and test. Debarred by your membership regulations from any vote in the matter, we are obliged to appeal to your sense of fairness first through your committee and now to yourselves in convention assembled. Were it not for the fact that the Interstate Commerce Commission invariably adopts your ruling, the case might not warrant our time or your consideration, but we feel that any hasty action on your part would work a hardship on the Independent Oil Refiners of this country to an extent you do not at first realize. The association for which I am speaking is composed of 35 refiners, located in mid-continent field, owning and operating approximately 8,000 tank cars, not because they desire to enter your domain, but because it has been found impossible to operate our refineries when relying upon the railroads for means of marketing our products.

The equipment register of January, 1916, gives the following as the number of tank cars owned by railroads represented on your committee:

Pennsylvania	490—none over 5,500 gallons capacity.
C. R. R. of N. J.	2—50,000 lb. capacity.
Erie	None.
B. & O.	7—capacity not given.
P. & L. E.	None.
	499—cars of ancient design.

Our association therefore owns over 16 times as many tank cars as the combined railroad system represented on your committee. There are two private tank lines represented by your committee, but we are appealing to your railroad men who operate our cars and not to private line owners.

The refining industry has increased so rapidly that the railroads have not provided the necessary equipment. Purchasing these 8,000 cars from year to year over your standard specifications the refiner has always endeavored to get the best and safest car, complying in every way to I. C. C. and Bureau of Explosives requirements, as well as your own. The refiner is in sympathy with safety first, and any movement necessary to safeguard the public and your traffic. Put to a heavy initial expense in the purchase of cars, we are helping the railroads by increasing your freight receipts and relieving you of maintenance and repair expense. The refiner does not feel it consistent for the railroads on their part to make such requirements as to increase unnecessarily this already heavy burden. The interest, depreciation, taxes, insurance and upkeep on tank car investment is an appreciable item in the high cost of gasolene. While you allow us ¾ cents mileage, the cost to us is nearer 2¼ cents per mile. We have been forced into car ownership and, to some extent, are now in partnership with you. An action inimical to us is also inimical to you.

Quoting from a railroad advertisement in the New York Times of June 14th, I find the following statement:

"The funds can be secured only by co-operation of the public, which should see that railroads are granted fair rates, insured just legislation, equitable taxation and reasonable demands for labor."

In the same spirit we now appeal from the public to the railroads for fair rates, and reasonable demands. From the advent of steel underframe, safety valve and center anchor regulations we have followed your lead to improve equipment. It was the introduction of the so-called "casing head gasoline" in about 1910 which first caused trouble, and we believe that a better understanding by you of the nature of this material compared to that of the ordinary refinery product will explain why we consider unnecessary your proposed specifications. This material is not a product of a refinery but of a compression plant. It is liquefied gas, made under 260 lb. pressure and 32 deg. temperature, which tends to return to its gaseous state at normal temperature and atmospheric pressure. Its vapor pressure exceeds 10 lb. per sq. in. at 100 deg.; in some cases nearly doubles this figure. It is therefore most volatile and its vapor mixed with air has proven to be highly explosive. It is stored in closed tanks under pressure to prevent it from boiling at any temperature above the freezing point of water. It should not be transported except in specially designed and insulated tanks at the reduced vapor tension prescribed by the Bureau of Explosives. We are in hearty accord with all rules your committee has promulgated in regard to this compressed material which, shipped in its wild state, is a menace to our refining products in transit. There is, however, about as much similarity between this compressed material and most refinery products, as there is between gunpowder and coal dust. While both are powdery substances of the same color, one readily explodes from contact with the smallest spark, while the other must attain a high temperature and be forced with air into your fire boxes before it will even ignite. So it is with our most volatile refinery products, gasolene, compared to this casing head material, both are colorless and both are liquids, but gasolene as transported to-day will not ignite when mixed with air much below 25 deg. F., and its boiling point is near 150 deg. F. This and naphtha are the most volatile of the refiners' products and still their vapor pressure is negligible.

Under your transportation rules, there has been no unusual trouble with these articles until the issue was confused by the advent of compression material. You should not class our products with this compression material any more than you would class coal with gunpowder, water with alcohol. Proceed with your special specifications for cars in which to transport compression gasolene, but do not on that account force us into additional expense by making us transport our mild material in similar cars. The whole school should not be punished for the pranks of one bad boy. Segregate the bad boy instead. Refinery products differ among themselves and differ from cotton seed oil, molasses, linseed oil, sulphuric acid, and other products carried in tank cars. A design cannot be made standard for all these various liquids as is proposed in Specification III without making the tank too strong for some and too light for others. Sulphuric acid makers, in order to insure strength for the material against corrosion, will use ½ in. shell sheets in spite of your ¼ in. by 5/16 in. specifications. Corrosion does not take place in oil tanks.

For many years a bursting pressure of 240 lb. per sq. in. has been found sufficient for good practice, and now your committee proposes 300 lb. when a tank never bursts even in compression gasolene accidents. Your committee states that "the requirements for Class III and Class IV cars have, as far as possible, been made the same with a view to facilitating the conversion of a Class III car into a Class IV car, if desired, at any time."

This principle we believe to be wrong, uncalled for and expensive. It is analogous to building your day coaches in such a manner that they may be converted into sleeping cars if desired at any time, or your box with insulation so that they may be converted into refrigerator cars if desired at any time. Such designing would constitute a useless expense.

If the setting of safety valves at 25 lb. represents what would be equivalent to a working pressure, a factor of safety of 4 used for your locomotive boiler would produce 100 lb. for bursting pressure. If, on the other hand, the 60 lb. test is the working pressure, the same factor of safety would produce 240 lb., your present standard. Since this pressure has been thoroughly tested since 1907, you should not compel us to invest more money in superfluous metal at a time when steel is expensive, nor should you burden your locomotives with the hauling of it. We are in favor of the increased thickness of metal prescribed for continuous bottom sheets, but believe that the thickness of shell and tank head should be designed to withstand 240 lb. pressure and not be governed by limiting tank diameters. This pressure would not require double riveting nor double calking on transverse seams. Every extra hole through shell sheets means one more chance for leakage and inside calking will not help the rivet hole.

Your proposd specifications for a convertible tank is originated at a time when the likelihood of such conversion is daily becoming more remote. The evaporation, amounting in some cases to 25 per cent of the load, in itself discourages tank car shipments of compression gasolene.

The material is now being blended at the point of manufacture and not sent as heretofore to the refinery for blending. By proper mixture with harmless naphthas and gasolene of low specific gravity it is tamed and civilized. Its vapor tension may be reduced to any limit desired. There is not today one-third the amount of wild compression gasolene shipped that there was two years ago, in spite of increased production to probably three times the former amount. It is blended at point of manufacture wherever possible, in order to save its outage. The demand for cars in which to transport it is diminishing and not increasing. Its transportation in raw state is special and not general.

What we request is, therefore, that you do not put this added expense upon us, but allow your present specifications to stand for petroleum and its products, eliminating the proposed convertible Specification III.

Under test of tanks, your committee decrees that "after January 1, 1918, all tanks in transportation service shall be tested to a pressure of 60 lb." We can interpret this in no other way than that tanks failing to meet this pressure will be thrown out of service. It means that your locomotive tenders must be so tested or discarded, as they are "tanks in transportation service." It means that fuel oil supply tanks must be made as good as though for high-grade gasolene; that your locomotive fuel oil tenders must be so tested or discarded. Such action on your part would be entirely too drastic and exceed even the requirements of the Bureau of Explosives, which limit to tanks tested to this figure the shipment of inflammable liquids with flash point lower than 20 deg., providing the vapor tension at 100 deg. F. does not exceed 10 lb. per sq. in. There is not a refinery product with a vapor tension even approximating to 10 lb. at 100 deg. F., and only one that will flash below 20 deg.—namely, high-grade gasolene. The grade you are permitted to consume in your automobiles will not flash at that. Compression gasolene exceeds this vapor pressure, but, as stated before, this is not the product of a refinery, but of a compression plant, and you are making special provision for its transportation according to I. C. C. regulations.

The Bureau of Explosives classifies an inflammable liquid as any liquid or liquid mixture that gives off inflammable vapors (as determined by flash point from Tagliabue's open cup tester, as used for test of burning oils) at or below 80 deg. F. A combustible liquid, as defined by your committee, is one that will burn on contact with fire, or one that will add materially to the severity of any fire with which it may come in contact.

Under these captions ordinary refinery products would line up about as follows:

INFLAMMABLE LIQUIDS.

High grade crude oil with flash point between 40 and 80 degrees.
Benzine with flash point between 55 and 65 degrees.
Gasolene with flash point between 18 and 40 degrees.
Naphtha with flash point between 65 and 70 degrees.

COMBUSTIBLE LIQUIDS.

Distillates whose flash point is between 92 and 98 degrees.
Turpentine substitute whose flash point is between 90 and 98 degrees.
Kerosene whose flash point is between 110 and 150 degrees.
Gas Oil whose flash point is between 215 and 300 degrees.
Neutrals whose flash point is between 380 and 390 degrees.
Fuel Oil (by U. S. Navy specification never below 175 degrees) whose flash point is between 230 and 250 degrees.
Crude Oil whose flash point is between 81 degrees and upwards.

We therefore request that this ruling of your committee be changed so that in case a tank will not stand 60 lb., but will stand 40 lb. or more, it may be used for transportation of combustible and non-combustible liquids, but not for inflammable liquids whose flash point is lower than 20 deg. or vapor tension above 10 lb. There are many tanks in service today never used nor intended for inflammable liquid service. To test these tanks to 60 lb. would tend to weaken them. Never called upon to stand such a severe strain, this excessive internal pressure might open up joints already tight and render useless a tank now available. If you should test your locomotive tenders to 10 lb. they would leak so you could never make them tight. We agree with you that all new tanks should stand this pressure and that tanks built heretofore should stand this pressure when used for transportation of certain inflammable liquids, as allowed by the Bureau of Explosives, but believe you should not prohibit the use of our older tanks for combustible liquids. We do not say that these older tanks will not stand the proposed 60 lb., as tests show that many do; but we do not want to subject them to this strain unnecessarily. If you require the 60-lb. test, regardless of material transported, many tank cars will be withdrawn from service at a time when they are scarce, expensive to replace, and then only with deliveries long delayed. One of your largest systems recently decided not to purchase its much-needed tank equipment solely because of the high cost of such cars.

To recapitulate we request:

First: That you recognize the difference between compression gasolene and ordinary refinery products, and do not attempt to design tanks so that they may be readily converted from one service to the other, especially since the demand for such conversions becomes daily more and more remote.

Second: That you continue the construction of tanks designed to withstand a bursting pressure of 240 lb. as heretofore, and do not specify metal thicknesses according to limiting diameters.

Third: That you permit the continued use as heretofore of single riveting and calking on transverse seams of tanks.

Fourth: That tanks now in service may be allowed to continue in service if tested to 40 lb. and so stencilled; for combustible liquids and inflammable liquids with flash point above 20 deg. and vapor pressure below 10 lb. at 100 deg.; but other inflammable liquids must be carried in tanks tested to 60 lb.

Fifth: That the shearing and bearing value of rivets for

anchorage to tank and underframe for different capacity tanks remains unchanged from present practice, except in Specification IV.

Further, we recommend that all bottom sheets be made in one continuous piece without transverse seams.

In regard to proposed Specification IV we have no contention, but have one query: Does your committee consider that a tank car designed to be used for a high tension inflammable liquid can be built without center sills or underframe and still be "of a degree of strength and firmness sufficient to withstand the inevitable shocks of ordinary transportation" as laid down by the Interstate Commerce Commission? It would seem to us much safer to limit your Specification IV to cars with center sills designed to take these shocks, leaving the tank free to devote its efforts to confining the liquid.

In regard to safety appliances for tank cars built after January 1, 1917, we are in accord.

In conclusion we wish to thank you for granting us this opportunity to appear before you, and trust that when registering your final decision you will bear in mind that what we have here said has been in a spirit of deliberation, and not criticism of the excellent work your committee has heretofore performed, especially so since your committee distinctly states that their reason for having formed Specification III is partly philanthropic.

Mr. Gibbs: The committee has heard one representative of the Association. I think some of the things, such as the last part of the remarks of Mr. Ames, brings up points settled by the Interstate Commerce Commission and by the Bureau of Explosives, where the Tank Car Committee does not feel that it has authority. Taking up the points as they came along, we considered fuel oil and crude oil different in that the crude oil contained gasolene and all the products. The committee believes with Mr. Ames that the safety valves are desirable for such purpose, but has not hitherto required them. The fuel may be crude or may be a distillate. We do think that the safety valves are a desirable thing, and we are sorry we have so many open vent cars, because in case of derailment or turning over of the car the product is lost. We recently had a two-day delay caused by an ammonia car being turned over in a tunnel and we could not get to it. We believe that the safety valve is a better thing than a vent. We find that some people are taking the lead vents and putting in seals which are sometimes stronger than the car. That is not much of a safety valve.

As to the No. 3 and No. 4 cars, if we are year by year to make recommendations to apply to existing tank cars, the owners will be everlastingly changing them. It is less of a hardship to say now what we would like to have in the future rather than to go back to the existing cars, and therefore Nos. 3 and 4 are separated. The information that came through Col. Dunn's office and some of the correspondence I have had, and the hearing before the Interstate Commerce Commission, indicate that that some of the refineries wish to ship a still wilder product than the one which is now allowed.

The reason for going into the details of the tank, as we have done is that some of the builders of tank cars say that they cannot afford to build a first-class car because somebody else can build a very inferior one and still meet the specifications. We thought it was fair to all hands to say what the Association wanted, so that people bidding on tank cars would know what they are bidding on. This matter was threshed out very carefully in the committee. We had representatives of the tank car builders, the tank car owners and the Bureau of Explosives, and these specifications No. 3 and 4, as they are put before you today have gone through the very careful criticism of those different interests.

Now, as to the other point, that the tank cars are thicker than the pressure requires, the tank car has two things to do: It has to stand the pressure of any liquid which is contained in it, and it also is a container which has to stand the buffeting and rough treatment, which is very considerable, from railroad operation, and in going over these specifications your committee considered the pressure for which the cars have been designed, and also considered the fact that, coupled with the strength to stand that compression pressure, there is a certain ruggedness of construction which is necessary to meet the transportation difficulties. That is the reason why the No. 3 and No. 4 cars are made so nearly alike.

E. T. Millar, (B. & M.): There are a number of tank cars in use that are carrying materials in connection with which it is necessary to have steam coils inside of the tanks. I see that there are no specifications or regulations in connection with these steam pipes which are used in tank cars as to how they should be applied to the tank car. There is also at the present time being handled quite a quantity of tanning material which is being exported. It is quite thin. It is an oak extract. If the connection between the steam pipe and the tank is ruptured, we will partly lose that material also.

O. D. Buzzell (A. T. & S. F.): We have heard something about the discontinuing of the outlet valve of tank cars. I do not believe, from the practical standpoint, that that can be done away with, and I would suggest or recommend that the committee consider the use of a secondary valve. We have found this secondary valve on the Pacific coast to be one of the greatest safeguards and remedies for our troubles in connection with bad valves, and we are going into it to a considerable extent. With a good secondary valve we can eliminate to a great extent the hazard that we have with our present outlet valve without any secondary valve.

C. E. Chambers (C. of N. J.): I feel that I should say something in defense of the Tank Car Committee, of which I have been a member for several years, and glad to have been. A good deal of time and thought has been given in all the years I have been on the committee, but especially in the last year, to trying to frame up what seems to be necessary rules and requirements to tank cars. A comparison has been made between the tank car and the locomotive tender. There is no proper comparison in that at all. We handle a great quantity of liquids today, and the carrier is responsible for anything that is lost, and this loss sometimes runs into a good many dollars. I think the suggestion of being hasty in this matter is altogether out of place, because for thirteen years rules have been in effect, although they have not always been respected, for building tank cars. People who have provided themselves with new cars during that time, which do not fully conform to the rules, have been taking chances against certain rules. In regard to the 60-lb. test on tank cars, I do not think it is altogether wrong, because a tank car standing still that would not stand a 60-lb. test under loaded conditions would not have much show in the handling the cars get in the hump yards and in the necessary movement of trains to-day over the line.

D. F. Crawford (Penna. Lines): It may be of interest to the association in connection with what Mr. Chambers said about the 60-lb. test. We have found that air pressure used in unloading tank cars to be frequently considerably in excess of 60 lb.

Mr. Gibbs: The committee recommends, first, that Fig. 8 showing the marking of tank cars can be submitted to the proper committee of the association on that subject, so that we may be consistent; and that the print showing the details of the safety appliance be submitted and receive the approval of the proper committee, and that the date of the application of the No. 3 and No. 4 tank car be made January 1, 1917.

The President: Mr. Smith, will you kindly restate your motion?

Mr. Smith: My motion was simply that the report be submitted to letter ballot, with the new specifications in lieu of the present specifications, and I accept the amendments which Mr. Gibbs has offered.

(The motion, as amended, was put to vote and carried.)

Specifications and Tests of Materials

Whenever desirable the committee has co-operated with the American Society for Testing Materials. This year's report includes the specifications for the balance of the material required in the construction of a freight car. The committee has also taken the M. C. B. lumber specifications and prepared a tabulation showing where each grade of lumber should be used in a car with provision for the proper alternates, taking the matter of territory into consideration. They have consulted with the manufacturing car builders and harmonized their views with those of the committee.

The members of this committee are all active workers and the chairman, C. D. Young, engineer of tests, Pennsylvania Railroad, lays particular stress on the fact that the specifications are the views of the entire committee and not of the chairman alone.

C. D. Young, Chairman

The other members of the committee are: J. R. Onderdonk, engineer of tests, Baltimore & Ohio; J. J. Birch, district car inspector, Norfolk & Western; I. S. Downing, general master car builder, Cleveland, Cincinnati, Chicago & St. Louis; Frank Zeleny, engineer of tests, Chicago, Burlington & Quincy; A. Copony, master car builder, Grand Trunk; A. H. Fetters, mechanical engineer, Union Pacific; H. B. MacFarland, engineer of tests, Atchison, Topeka & Santa Fe, and G. S. Sprowle, superintendent of motive power, Atlantic Coast Line.

THE committee recommends:

(a) That the specifications for the following material, as shown by Appendix *A*, be submitted to letter ballot as Recommended Practice: Bolts and Nuts; Spirits of Turpentine; Raw Linseed Oil; Boiled Linseed Oil; Oxide of Iron Paste; Japan Drier; Red Lead; White Lead, and Carbon Steel Bars for Railway Springs.

(b) That the Specifications for Air Brake Hose Gaskets (Standard), be modified in accordance with Appendix *B*.

(c) That the Specifications for Steel Axles (Standard), be modified in accordance with Appendix *C*.

(d) That the specifications for Rivet Steel and Rivets (Recommended Practice) be modified in accordance with Appendix *D*.

(f) The committee, after studying the available material, in view of the large number of proprietary articles on the market, submit the formulae for cement to be used in mounting air brake hose as shown by Appendix *E*.

(h) That the following specifications be advanced from Recommended Practice to Standard Practice: Specifications for Steam Heat Hose for Passenger Equipment Cars, and Specifications for Helical Springs, as modified by Appendix *G*.

(i) That the Specifications for Journal Bearings for Passenger and Freight Equipment Cars be modified as shown by Appendix *F*.

(j) Some three years ago the question of the proper limitation on tensile strength for air brake hose was submitted to this committee for consideration. After an extended test upon the Canadian Pacific, E. B. Tilt, engineer of tests, submitted to us the following report:

"With reference to the freezing tests on air brake hose; Fig. 1 shows the results of the tests. The point to be determined was whether the upper limit of tensile strength of the tube and cover was necessary in order to exclude air brake hose showing a high tensile strength, on account of its being more easily hardened and therefore less flexible in cold weather. Most air brake hose has a sharp hardening point between zero and 10 deg. above zero, and so, too, hose which is the least flexible at normal temperatures is also the least flexible at the lowest temperatures. The diameters and wall thicknesses and weights have very little effect upon the flexibility of the hose.

"A consideration of the tensile strength does not indicate that the rubber of high tensile strength is the least flexible at a low temperature in hose. It is the opinion, therefore, that the upper limit for tensile strength of the tube and cover may be increased without any fear of injuring the hose of least flexibility at low temperatures, that we are at present being supplied with under the M. C. B. specification as now written."

The committee has reviewed the work of this subcommittee and is of the opinion that the present specifications amply protect the consumer, so far as the stiffness of the hose under low temperature conditions is concerned, and, therefore, the committee has no changes to recommend.

(k) The committee is continuing the tests on the special air brake hose purchased in 1913, in which the laboratory tests have been combined with the service tests of special hose furnished by the manufacturers. Judging from the results thus far obtained on this test, the indications are that no special changes will be made in existing hose specifications. The committee has developed two points of weakness in the air brake hose, namely, the rapid checking of the cover on certain grades of air brake hose and the inequality of the strength of the warp and filler of the duck. These two questions are now under consideration.

The greatest assistance to this committee by the members will come about through the members using the new Standard and Recommended Practice Specifications.

APPENDIX A.

SPECIFICATIONS FOR BOLTS AND NUTS

I. MANUFACTURE

2. *Process.*—The bolts and nuts may be made from wrought iron or steel, made in accordance with M. C. B. Specifications for Refined Wrought Iron Bars or Mild Steel Bars.

6. *Threads.*—Nuts shall be so tapped that a U. S. standard plug gage of normal size will pass through the nut, and in that position be snug and not show an appreciable shake. Bolts to be threaded so as to fit the nut in such a manner that it may be turned to within one thread of the end of the threaded portion of the bolt. When in this position there shall be no appreciable shake.

7. *Finished Bolt and Nut.*—The finished bolt and nut shall conform in its finished dimensions to Tables No. 1 and No. 2.* The permissible variation from this to be as follows: For nuts under ½ in., 1-16 in. under and 1-64 in. over. For nuts ½ in. and larger, 1-16 in. under and 3-64 in. over. All other dimensions of nuts and heads of bolts, 1-16 in. variation either way will be permitted, except for bolts and nuts under ½ in., 1-32 in. variation either way will be permitted.

8. *Tapping of Nuts.*—The nuts shall be tapped so that,

*Table II is the Proportions for Sellers' Standard Nuts and Bolts previously adopted by the Association.

when applied, the bearing surface shall be within two deg. of the angle formed by the nut and the surface upon which it bears.

9. Length.—The finished length shall not vary more than ⅛ in. from the ordered dimension and, unless otherwise specified, the threads shall be cut 2½ times the diameter of the bolt.

V. WORKMANSHIP AND FINISH

10. Workmanship.—The heads of all bolts shall be neatly formed, firmly joined to the body of the bolt, free from large projecting fins and no nicking or reduction of the size of the body of the bolt by dies.

11. Threads.—Bolts and nuts shall be cut with a U. S. and M. C. B. standard thread, the threads being cut full and

2. Appearance.—The turpentine shall be clear and free from suspended matter and water.

3. Color.—The color shall be "Standard" or better.

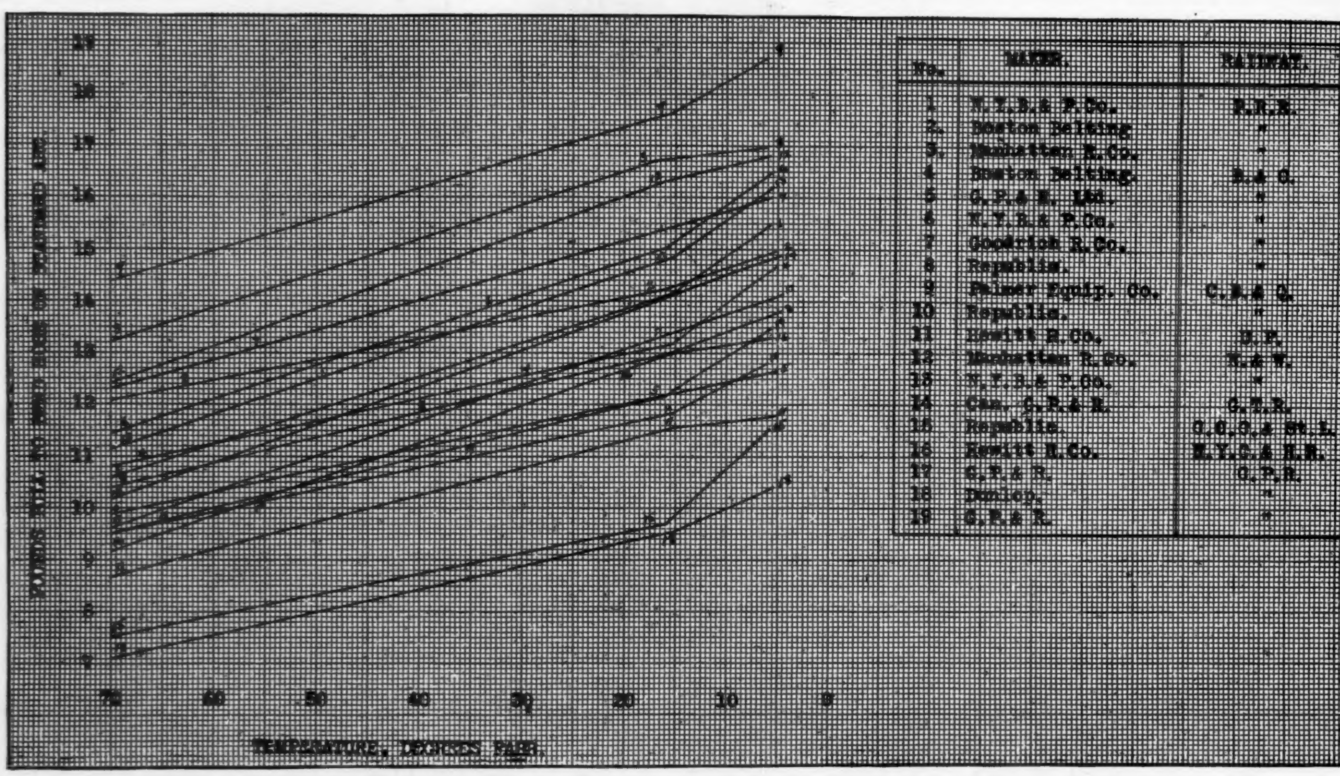
4. Specific Gravity.—The specific gravity shall not be less than 0.862 nor more than 0.872 at 15.5 deg. C.

5. Refractive Index.—The refractive index at 15.5 deg. C. shall not be less than 1.468 nor more than 1.478.

6. Initial Boiling Point.—The initial boiling point shall not be less than 150 nor more than 160 deg. C.

7. Distillation.—Ninety per cent of the turpentine shall distill below 170 deg. C.

8. Polymerization.—The polymerization residue shall not exceed 2 per cent, and its refractive index at 15.5 deg. C. shall not be less than 1.500.



		Dimensions of Hose.					Cover.					Tube.				
Maker	Test No.	Length In.	Weight oz.	Outside Diam. In.	Inside Diam. In.	Wall T'kss In.	T'kss In.	Set. 30 Sec. In.	Set. 10 Min. In.	Tens. Str. lb.	Elong. %	T'kss In.	Set. 30 Sec. In.	Set. 10 Min. In.	Tens. Str. lb.	Elong. %
Palmer, E. Co.	9	22-5/16	29-½	2.035	1.38	0.323	0.067	7/16	1/16	1210	512	0.093	¾	1/16	1484	550
Manhattan.	3	22-3/16	33-½	2.049	1.37	0.336	0.058	3/16	0	1103	600	0.101	¼	1/16	1180	475
N. Y. B. & P.	6	22-1/16	34	2.032	1.40	0.348	0.060	3/16	0	1066	525	0.106	⅛	0	1111	525
Hewitt.	11	22-3/16	27	2.073	1.38	0.342	0.061	¼	0	1200	500	0.097	⅜	1/16	1354	500
Republic.	15	22-⅛	31-¾	2.067	1.39	0.343	0.074	¼	1/16	1080	625	0.101	⅜	⅛	1113	550
Dunlop.*	18	21-15/16	27-½	2.057	1.40	0.325	0.048	¼	0	833	500	0.085	⅜	0	1309	400

*Nonfreezing Hose.

Fig. 1.—Freezing Tests on Air Brake Hose

clean. Unless otherwise specified, each bolt shall be furnished with a nut screwed on.

12. Finish.—Where the keyways are cut in the ends of bolts, they shall be full and clean and the metal around them shall show that it has not been injured by cutting the keyways more than is necessary.

PROPOSED SPECIFICATIONS FOR TURPENTINE.

1. Scope.—These specifications apply to both the turpentine that is distilled from pine oleoresins, and commonly known as "gum turpentine" or "spirits turpentine," and to the turpentine commonly known as "wood turpentine" that is obtained from resinous wood, whether by extraction with volatile solvents, steam or by destructive distillation, to be used in making paint for M. C. B. equipment cars.

9. Odor.—Shall not have an offensive or empyreumatic odor.

METHODS OF ANALYSIS

10. Color.—Fill a 200-mm., perfectly flat bottom colorimetric tube graduated in millimeters to a depth of from 40 to 50 mm. with the turpentine to be examined. Place the tube in a colorimeter and place on or under it a No. 2 yellow Lovibond glass. Over or under a second graduated tube in the colorimeter, place a No. 1 yellow Lovibond glass and run in the same turpentine until the color matches as nearly as possible the color in the first tube. Read the difference in depth of the turpentine in the two tubes. If this difference is 50 mm. or more, the turpentine is "Standard."

11. Specific Gravity.—Determine specific gravity at any

convenient temperature with a plummet, the displacement of which has been accurately determined for that temperature, or by an equally accurate method, using the factor 0.00082 for each degree centigrade that the temperature of determination differs from 15.5 deg. C.

12. Refractive Index.—Determine refractive index at any convenient temperature with an accurate instrument, and calculate the results to 15.5 deg. C. using the factor 0.00045 for each degree that the temperature of determination differs from 15.5 deg. C.

13. Distillation.—Use an ordinary Engler flask and condenser, and heat the flask by placing it in a glycerin or oil bath of the general type described in Bulletin No. 135, Bureau of Chemistry. Fit the flask with a thermometer reading from 145 to 200 deg. C. in such a way that the mercury bulb shall be opposite the side tube of the flask and the 175 deg. mark below the cork. Place 100 cc. of the turpentine to be examined in the flask, connect with the condenser, insert stopper bearing thermometer, and heat until distillation of the turpentine begins. Conduct the distillation so that the distillate passes over at the rate of two drops per second. Note the initial distilling temperature and the percentage distilling below 170 deg. C.

14. Polymerization.—Place 20 cc. of exactly 38/N (100.92 per cent) sulphuric acid in a graduated, narrow-neck Babcock flask, stoppered, and place in ice water and cool. Add slowly 5 cc. of the turpentine to be tested. Gradually mix the contents, cooling from time to time, and not allowing the temperature to rise above about 60 deg. C. When the mixture no longer warms up on shaking, agitate thoroughly and place the bottle in a water bath and heat from 60 to 65 deg. C. for about ten minutes, keeping the contents of the flask thoroughly mixed by vigorous shaking five or six times during the period. Do not stopper the flask after the turpentine has been added, as it may explode. Cool to room temperature, fill the flask with concentrated sulphuric acid until the unpolymerized oil rises into the graduated neck. Centrifuge at about 1200 r.p.m. from four to five minutes, or allow to stand for twelve hours. Read unpolymerized residue, notice its consistency and color, and determine its refractive index.

PROPOSED SPECIFICATIONS FOR RAW LINSEED OIL

1. Scope.—These specifications apply to linseed oil to be used in mixing paint for M. C. B. equipment cars.

I. PROPERTIES AND TESTS

2. Properties.—The material should be good, pure oil of a pale yellow color, made from No. 1 flaxseed, well clarified by settling and age and unmixed with any foreign substance whatever. The raw linseed oil shall conform to the following requirements:

	Max.	Min.
Specific gravity at $\frac{15.5\text{ deg.}}{15.5\text{ deg.}}$ C.	0.936	0.932
or		
Specific gravity at $\frac{25\text{ deg.}}{25\text{ deg.}}$ C.	0.931	0.927
Acid number	6.00	....
Saponification number	195	189
Unsaponifiable matter, per cent	1.50	....
Refractive index at 25 deg. C.	1.4805	1.4790
Iodine number (Hanus)		178
Flash point		260

II. METHODS OF TESTING

3. General.—All tests are to be made on oil which has been filtered at a temperature of between 60 and 80 deg. F. through paper in the laboratory immediately before weighing out. The sample should be thoroughly agitated before the removal of a portion for filtration or analysis.

4. Specific Gravity.—Use a pyknometer, or Westphal balance, accurately standardized and having a capacity of at least 25 cc. or any other equally accurate method, making a test at 15.5 deg. C., water being at 15.5 deg. C., or a test at 25 deg. C., water being 1 at 25 deg. C.

5. Acid Number.—Expressed in milligrams of KOH per gram of oil. Follow the method described in Bulletin No. 107, revised 1908, Department of Agriculture, Bureau of Chemistry, page 142.

6. Saponification Number.—Expressed as with acid number. Blanks should also be run to cover effect of alkali in glass. Follow method given in Bulletin No. 107, revised 1908, Department of Agriculture, Bureau of Chemistry, pages 137-138.

7. Unsaponifiable Matter.—Follow Boemer's method taken from his Ubbelohde Handbuch der Ole u. Fette, pages 261-262. Or, any accurate method involving the extraction of the dried soap may be used.

TABLE No. 1.

Diam. of Screw.	SCREW THREADS.			NUTS. Hexagon and Square.				HEADS. Hexagon and Square.			
	Threads per In.	Diam. at Root of Thread.	Width of Flat.	Short Diameter.		Thickness.		Short Diameter.		Thickness.	
				Rough.	Finish.	Rough.	Finish.	Rough.	Finish.	Rough.	Finish.
1/4	20	.185	.0062	1/2	7/16	1/4	3/16	3/8	5/16	3/16	1/8
5/16	18	.240	.0074	19/32	17/32	5/16	1/4	15/32	13/32	15/64	11/64
3/8	16	.294	.0078	11/16	5/8	3/8	5/16	9/16	1/2	9/32	7/32
7/16	14	.344	.0089	25/32	23/32	7/16	3/8	21/32	19/32	21/64	17/64
1/2	13	.400	.0096	7/8	13/16	1/2	7/16	3/4	11/16	3/8	5/16
9/16	12	.454	.0104	31/32	29/32	9/16	1/2	27/32	25/32	27/64	23/64
5/8	11	.507	.0113	1 1/16	1	5/8	9/16	15/16	7/8	15/32	13/32
3/4	10	.620	.0125	1 1/4	1 3/16	3/4	11/16	1 1/8	1 1/16	9/16	1/2
7/8	9	.731	.0138	1 7/16	1 3/8	7/8	13/16	1 5/16	1 1/4	21/32	19/32
1	8	.837	.0156	1 5/8	1 9/16	1	15/16	1 1/2	1 7/16	3/4	11/16
1 1/8	7	.940	.0178	1 13/16	1 3/4	1 1/8	1 1/16	1 11/16	1 5/8	27/32	25/32
1 1/4	7	1.065	.0178	2	1 15/16	1 1/4	1 3/16	1 7/8	1 13/16	15/16	7/8
1 3/8	6	1.160	.0208	2 3/16	2 1/8	1 3/8	1 5/16	2 1/16	2	1 1/32	31/32
1 1/2	6	1.284	.0208	2 3/8	2 5/16	1 1/2	1 7/16	2 1/4	2 3/16	1 1/8	1 1/16
1 5/8	5 1/2	1.389	.0227	2 9/16	2 1/2	1 5/8	1 9/16	2 7/16	2 3/8	1 7/32	1 5/32
1 3/4	5	1.491	.0250	2 3/4	2 11/16	1 3/4	1 11/16	2 5/8	2 9/16	1 5/16	1 1/4
1 7/8	5	1.616	.0250	2 15/16	2 7/8	1 7/8	1 13/16	2 13/16	2 3/4	1 13/32	1 11/32
2	4 1/2	1.712	.0277	3 1/8	3 1/16	2	1 15/16	3	2 15/16	1 1/2	1 7/16
2 1/4	4 1/2	1.961	.0277	3 1/2	3 7/16	2 1/4	2 3/16	3 3/8	3 5/16	1 11/16	1 5/8
2 1/2	4	2.175	.0312	3 7/8	3 13/16	2 1/2	2 7/16	3 3/4	3 11/16	1 7/8	1 13/16
2 3/4	4	2.425	.0312	4 1/4	4 3/16	2 3/4	2 11/16	4 1/8	4 1/16	2 1/16	2
3	3 1/2	2.629	.0357	4 5/8	4 9/16	3	2 15/16	4 1/2	4 7/16	2 1/4	2 3/16
3 1/4	3 1/2	2.879	.0357	5	4 15/16	3 1/4	3 3/16	4 7/8	4 13/16	2 7/16	2 3/8
3 1/2	3 1/4	3.100	.0384	5 3/8	5 5/16	3 1/2	3 7/16	5 1/4	5 3/16	2 5/8	2 9/16
3 3/4	3	3.317	.0416	5 3/4	5 11/16	3 3/4	3 11/16	5 5/8	5 9/16	2 13/16	2 3/4
4	3	3.567	.0416	6 1/8	6 1/16	4	3 15/16	6	5 15/16	3	2 15/16
4 1/4	2 7/8	3.798	.0434	6 1/2	6 7/16	4 1/4	4 3/16	6 3/8	6 5/16	3 3/16	3 1/8
4 1/2	2 3/4	4.028	.0454	6 7/8	6 13/16	4 1/2	4 7/16	6 3/4	6 11/16	3 3/8	3 5/16
4 3/4	2 5/8	4.255	.0475	7 1/4	7 3/16	4 3/4	4 11/15	7 1/8	7 1/16	3 9/16	3 1/2
5	2 1/2	4.480	.0500	7 5/8	7 9/16	5	4 15/16	7 1/2	7 7/16	3 3/4	3 11/16
5 1/4	2 1/2	4.730	.0500	8	7 15/16	5 1/4	5 3/16	7 7/8	7 13/16	3 15/16	3 7/8
5 1/2	2 3/8	4.953	.0526	8 3/8	8 5/16	5 1/2	5 7/16	8 1/4	8 3/16	4 1/8	4 3/16
5 3/4	2 3/8	5.203	.0526	8 3/4	8 11/16	5 3/4	5 11/16	8 5/8	8 9/16	4 5/16	4 1/4
6	2 1/4	5.423	.0555	9 1/8	9 1/16	6	5 15/16	9	8 15/16	4 1/2	4 7/16

8. Refractive Index.—Use a properly standardized Abbe Refractometer at 25 deg. C. or any other equally accurate instrument.

9. Iodine Number (Hanus): Follow the Hanus method as described in Bulletin No. 107, revised 1908, Department of Agriculture, Bureau of Chemistry, page 136.

PROPOSED SPECIFICATIONS FOR BOILED LINSEED OIL

1. Scope.—These specifications apply to boiled linseed oil to be used in mixing paint for M. C. B. equipment cars.

I. PROPERTIES AND TESTS

2. Properties.—Boiled linseed oil shall conform to the following requirements:

	Max.	Min.
Specific gravity at $\frac{15.5\text{ deg.}}{15.5\text{ deg.}}$ C.	0.945	0.937
Acid number	8	....
Saponification number	195	189
Unsaponifiable matter, per cent	1.5	....
Refractive index at 25 deg. C.	1.484	1.479
Iodine number (Hanus)	....	178
Ash, per cent	0.7	0.2
Manganese, per cent	....	0.03
Calcium, per cent	0.3	....
Lead, per cent	....	0.1
Flash point	....	260 C.

II. METHODS OF TESTING

3. General.—The sample should be thoroughly agitated before the removal of a portion for analysis.

4. Specific Gravity.—Use a pyknometer, or Westphal balance, accurately standardized and having a capacity of at least 25 cc. or any other equally accurate method, making a test at 15.5 deg. C., water being 1 at 15.5 deg. C.

(Paragraphs 5, 6, 7, 8 and 9 are identical with those of the same number in the previous specifications.)

10. Ash.—The determination of the percentage of ash and the constituents thereof may be made by any method which gives accurate results.

SPECIFICATIONS FOR OXIDE OF IRON PASTE

1. Scope.—These specifications cover oxide of iron paste to be used in painting freight equipment cars, and as a priming or subsequent coats on steel cars.

I. CHEMICAL PROPERTIES AND TESTS

2. Chemical Composition.—(a) The paste shall conform to the following:

Pigment	70-75 per cent by weight
Oil	24-29 per cent by weight
Moisture	not over 1 per cent by weight

(*b*) *Pigment.*—(1) The pigment shall conform to the following:

Sesquioxide of iron	not less than 25 per cent by weight
Carbonate of lime	2-5 per cent by weight
Inert material	Remainder.

(2) The pigment desired, if it contains sulphate of lime or gypsum, should have this fully hydrated. It should contain only such inert material as occurs with it in nature, with no addition of barytes, aniline colors, lakes or any other inorganic coloring matter. The inert material may contain sulphate of lime or gypsum, fully hydrated, silica, kaolin, soapstone, asbestine, or mixtures of any of these, sulphate of lime, and silica preferred.

3. Oil.—The linseed oil shall conform to the M. C. B. Specifications for linseed oil.

II. PHYSICAL PROPERTIES AND TESTS

4. Fineness.—(a) The pigment shall be so fine that after having been separated from the oil and freed from hygroscopic moisture and then thoroughly mixed again with pure raw linseed oil, which has also been freed from moisture in the proportion of one part oil to one part pigment by weight, it will stand the following:

(b) Place a small amount of the above mixture on one end of a strip of dry glass, set the strip vertical where the temperature is 70 deg. F. and allow to remain for thirty minutes.

(c) As the mixture runs down the glass, the fineness will be acceptable if the oil and pigment does not separate in the first inch.

5. Drying.—Mix thoroughly the paste received with sufficient pure raw linseed oil to properly thin it for use; when thinned in this way and without the use of drier, the mixture shall dry on a piece of glass within seventy-two hours at a temperature between 60 and 80 deg. F.

6. Shade.—(a) Samples of standard pigment showing shade desired will be furnished and shipments shall conform to standard shade.

(b) The shade of paint being affected by grinding, the railroad company's standard shade is that given by the dry sample mixed with the proper amount of oil and ground, or better, rubbed up in a mortar until the paste will pass the railroad company's test for fineness. As the comparison should always be made with fresh samples, samples should be made up for each day's testing. After paint has become dry it shall not be used further.

(c) The comparison can best be made by putting a small amount of the Standard paste and that to be compared in hillocks near each other on glass, and then lay a thin piece of glass as a cover on the two hillocks and press them together until the two samples unite. It is recommended to use the microscopist's cover glass for the glass used as a cover, as this thin glass does not change the shade perceptibly. The line where the two samples meet will be clearly marked if they are not of the same shade.

7. Samples.—Sample of paste shall be taken from one barrel, can or package in each shipment for test purposes.

III. PERMISSIBLE VARIATIONS

8. Weight.—As quotations are made by the pound, on the basis of the paint weighing not over 15½ lb. per gallon, all paint received which weighs more than 15½ lb. per gallon but not over 16½ lb. per gallon will be accepted at the weight of 15½ lb. per gallon, the excess weight being at the expense of the manufacturer.

SPECIFICATIONS FOR JAPAN DRIER

1. Scope.—These specifications cover hardener and drier or japan to be used in making paint for freight equipment cars.

I. PHYSICAL PROPERTIES AND TESTS

2. Drying Test.—(a) *Turpentine.*—When equal parts by weight of the japan of pure turpentine (M. C. B. Specifications for Turpentine) are thoroughly mixed and poured over a slab of glass, which is then placed nearly vertically at a temperature of 100 deg. F. with free access of air, but not exposed to draught, the coating shall be hard and dry, neither brittle nor sticky, in not exceeding twelve minutes.

(b) *Linseed Oil.*—When 15 per cent of japan and 85 per cent of pure raw linseed oil (M. C. B. Specifications for Linseed Oil) by weight are thoroughly mixed and poured over a slab of glass which is then placed nearly vertical at a temperature of from 65 to 85 deg. F. with free access of air, but not exposed to draught, the coating shall dry throughout, neither brittle, nor sticky, within four hours.

3. Curdling Test.—When thoroughly mixed with pure raw linseed oil at the ordinary temperature in proportion of 5 per cent by weight of japan to 95 per cent by weight of raw linseed oil, no curdling shall result, nor any marked separation or settling on standing.

4. Residue Test.—When five cubic centimeters of the japan are poured into 95 cubic centimeters of pure turpentine at the ordinary temperature and thoroughly shaken, a clear solution shall result, without residue, on standing one hour.

SPECIFICATIONS FOR RED LEAD

1. Scope.—These specifications cover a high-grade commercial dry red lead, to be used in paint mixtures or as a priming coat. When used in priming coat it should be made up fresh for quick application to prevent setting. When less than three per cent of litharge is present, it may be mixed up in paste form and held indefinitely.

2. Composition.—The dry pigment, which is probably a mixture of lead monoxide and lead dioxide, should contain at least 85 per cent of true red lead, Pb_3O_4, equivalent to 30.60 per cent of lead dioxide, and the remainder to be practically pure lead monoxide.

3. Color.—The pigment must be of bright color, free from organic coloring matter.

I. METHODS OF ANALYSIS

4. Total Lead.—(a) The total lead content will be obtained, after removal of insoluble matter, as sulphate.

(*b*) *Red Lead, Pb_3O_4.*—Weigh out 0.5 gram of pigment as received into a dry 125-cc. Erlenmeyer flask. Into a dry 150-cc. beaker place in the following order: 15 grams crystallized sodium acetate, 1.2 grams potassium iodide, 5 cc. distilled water, and 5 cc. 50 per cent acetic acid. Mix thoroughly until solution effected, pour into the Erlenmeyer flask containing the lead, and rub with a glass rod until all the lead is dissolved; add 15 cc. of cold distilled water and titrate with tenth-normal sodium thiosulphate; using starch as indicator. A small amount of the lead may escape solution at first, but when the titration is nearly complete this may be dissolved by stirring. The reagents used to be analyzed chemicals, and should be pulverized just before using. The titration should be started as soon as the greater part of the lead is in solution and should be carried to completion as soon as possible, as otherwise there is danger of loss of iodine. One cubic centimeter of tenth-normal sodium thiosulphate corresponds to 0.011945 gram of lead dioxide or 0.034235 gram of red lead.

(*c*) *Lead Monoxide, PbO.*—Calculate the red lead found under (b) to sulphate, deduct this weight from the total weight of sulphate under (a) and calculate the difference to lead monoxide.

(*d*) *Moisture.*—One gram of the pigment as received will be dried at a temperature of 220 deg. F. for two hours, and the loss in weight calculated and expressed as per cent moisture.

(*e*) *Insoluble Impurities.*—Treat 1 gram of pigment with 20 cc. of concentrated hydrochloric acid, cover and heat on a steam bath for 15 minutes, add 100 cc. of hot water, boil, filter, wash with hot water, ignite, and weigh the insoluble residue. The weight found should be expressed as per cent insoluble matter.

(Paragraph 5 is the same as paragraph 4 under Specifications for Oxide of Iron Paste.)

II. INSPECTION AND REJECTION

7. Rejection.—The material will have failed and will be rejected if the tests herein required show the following:

(1) Less than 85 per cent true red lead, Pb_3O_4.
(2) Moisture in excess of 0.25 per cent.
(3) The presence of organic coloring matter.

SPECIFICATIONS FOR WHITE LEAD FOR LETTERING

1. Scope.—These specifications cover two kinds of white lead paste to be used as a base in stencil paint for freight equipment cars.

I. CHEMICAL PROPERTIES AND TESTS

2. Chemical Composition.—(a) Paste. The paste shall conform to the following:

Pigment	90-93 per cent by weight
Oil	7-10 per cent by weight
Moisture, mechanical, combined with pigment or oil	not over 0.25 per cent by weight

(*b*) *Pigment.*—The composition of the pigment shall conform to either the following:

(1) Basic carbonate of lead:

Lead carbonate	68-75 per cent by weight
Lead hydrate	25-32 per cent by weight
Lead sulphate	not over 0.5 per cent by weight
Acetates	not any.

(2) Equal parts of basic carbonate and basic sulphate white lead:

Lead carbonate	34. -37.5 per cent by weight
Lead sulphate	37. -42.5 per cent by weight
Lead hydrate	12.5-16 per cent by weight
Lead oxide	5. -10 per cent by weight
Zinc oxide	2. - 4 per cent by weight
Water soluble	not over 0.5 per cent by weight
Lead acetate	None.

(c) The pigment shall conform to the railroad company's standard sample as far as fineness, opacity and density are concerned and shall not have a crystalline structure or any adulterants.

3. Oil.—The linseed oil shall conform to the M. C. B. Specifications for Linseed Oil.

(Paragraph 4 is the same as paragraph 4 under Specifications for Oxide of Iron Paste.)

SPECIFICATIONS FOR CARBON STEEL BARS FOR RAILWAY SPRINGS

1. Scope.—(a) These specifications cover two classes of bars, determined by their carbon ranges as specified in Section 3.

(b) The purposes for which these classes are frequently used, depending upon the design and upon the stresses and services to be imposed, are as follows:

Class A, for elliptical and helical springs.
Class B, for helical springs.

I. MANUFACTURE

2. Process.—The steel shall be made by the open-hearth, crucible or electric process.

II. CHEMICAL PROPERTIES AND TESTS

3. Chemical Composition.—The steel shall conform to the following requirements as to chemical composition:

	Class.	
Elements Considered.	A.	B.
Carbon, per cent	0.90—1.10	0.95—1.15
Manganese, max. per cent	0.50	0.50
Phosphorous, max. per cent	0.05	0.05
Sulphur, max. per cent	0.05	0.05

III. PERMISSIBLE VARIATIONS IN GAGE

6. Permissible Variations.—The dimensions of the bars shall not vary from those ordered more than the amount shown in the following table:

FLATS

	Width, in.		Thickness, In. Up to ⅜ in., Inclusive.		Thickness, In. Over ⅜ to ¾ in., Inclusive.	
Size.	Over.	Under.	Over.	Under.	Over.	Under.
1 to 2 in., incl.	0.015	0.015	0.015	0.005	0.015	0.010
Over 2 to 4 in., incl.	0.047	0.015	0.015	0.005	0.015	0.010
Over 4 to 5 in., incl.	0.047	0.032	0.015	0.005	0.015	0.010
Over 5 to 6 in., incl.	0.062	0.032	0.015	0.005	0.015	0.010

ROUNDS AND SQUARES

	Diameter or Thickness, In.	
Size.	Over.	Under.
Up to 5/16 in., incl	0.005	0.005
Over 5/16 to 7/16 in., incl	0.007	0.005
Over 7/16 to ⅜ in., incl	0.009	0.005
Over ⅝ to ⅞ in., incl	0.010	0.006
Over ⅞ to 1 in., incl	0.011	0.007
Over 1 to 1⅛ in., incl	0.012	0.008
Over 1⅛ to 1¼ in., incl	0.013	0.009
Over 1¼ to 1⅜ in., incl	0.014	0.010
Over 1⅜ to 1½ in., incl	0.016	0.011
Over 1½ to 2 in., incl	0.019	0.012

[NOTE.—Only the more important paragraphs of the specifications shown in this Appendix are included in this abstract.—EDITOR.]

APPENDIX B.

SPECIFICATIONS FOR AIR BRAKE HOSE GASKETS

Add the following as Section 1: *1. Scope.*—These specifications include all air brake hose gaskets.

Add the following as Section 5: *5. Marking.*—Each air brake hose gasket shall be marked on the inside edge with

Fig. 2.—M. C. B. Standard Air Brake Hose Monogram

the following: Manufacturer's name or trade-mark, M. C. B. Standard monogram and the date when made, as shown by Fig. 2.

APPENDIX C.

On page 717, M. C. B. 1915 Proceedings, Specifications for Steel Axles.

In Section 5, paragraph (a), insert after the word "supports" in the first line the words "three feet apart."

Omit table on page 718, and substitute the following table:

New Table

Weight of Tup, 2,240 Lb.
Supports 3 Ft. Apart.

Size of Axle, In. Journal.	Diameter at Center.	Height of Drop, Ft.	Number of Blows.	Maximum Permanent Set after First Blow. In.
4¼ x 8	4¾	22½	5	7½
5 x 9	5⅜	29	5	6½
5½ x 10	5⅞	34½	5	5½
6 x 11	6 7/16	41½	5	4½

Insert the following as paragraph (b):

(b) Formula: (1) The above heights of drop were derived from the following formula:

$H = d^2$.

H = height of drop in feet.

d = diameter of axle at center in inches.

(2) The above values for maximum permanent set after first blow were derived from the following formula:

$$\text{Maximum permanent set in inches} = \left(\frac{L}{1.9d} - \frac{d}{2}\right) + \frac{3}{4}\text{ in.}$$

L = length of axle in inches.

Change paragraph (b) to (c).

Note.—The value derived from the above formula for permanent set was 5 in. for the 6 by 11 axle, but the allowable permanent set was dropped to 4½ in. as more nearly representing what would be obtained in practice.

APPENDIX D.

SPECIFICATIONS FOR RIVET STEEL AND RIVETS FOR PASSENGER AND FREIGHT EQUIPMENT CARS

Make the following change in section 2, page 1051:

Phosphorus....not over 0.04 per cent, instead of 0.05 per cent.

Sulphur........not over 0.045 per cent, instead of 0.05 per cent.

Insert in section 5, page 1052, in the first line immediately after the section heading, the following: (a) "Unless otherwise specified one bar," etc.

Insert the following as paragraph (b): "Where accurate account of the material has been kept, and it is presented as complete melts, only one sample for each diameter, for chemical analysis, shall be taken from either the bars or the finished rivets for each melt."

Insert in section 9, after the sectional heading in the first line, the following: (a) Unless otherwise specified." Insert as paragraph, "(b) When accurate account of the material has been kept and it is presented as a complete melt, only one of physical test specimen for each diameter shall be taken from the bars or finished rivets for each melt."

APPENDIX E.

SPECIFICATIONS FOR CEMENT FOR MOUNTING AIR BRAKE HOSE

Shellac: Dissolve 5 lb. of dry shellac in 1 gal. of denatured alcohol and add 2 oz. of castor oil.

Rubber: Dissolve from 4 to 10 oz. of raw rubber (preferably Para) in 1 gal. of gasoline or benzol.

APPENDIX F.

On page 1047, M. C. B. 1915 Proceedings, change Section 5, tests, as follows:

Omit the word "bearing" in the first line and substitute the word "casting." In the second line omit the words "along the center line of the bearings," and substitute the words "either longitudinally or transversely, or both." In the fourth line omit the words "distinct signs of imperfect mixing such as," and after the word "separation" insert the words "or imperfect mixing."

APPENDIX G.

On page 958, M. C. B. 1915 Proceedings, Specifications for Helical Springs, insert the following as Section 10: "10. *Dimensions of Bars.*—The dimensions of square and round bars shall not vary from those ordered more than the amount shown by the following table:"

Table

Size.	Diameter or Thickness, In. Over.	Under.
Up to 5/16 in., incl.	0.005	0.005
Over 5/16 to 7/16 in., incl.	0.007	0.005
Over 7/16 to ⅝ in., incl.	0.009	0.005
Over ⅝ to ⅞ in., incl.	0.010	0.006
Over ⅞ to 1 in., incl.	0.011	0.007
Over 1 to 1⅛ in., incl.	0.012	0.008
Over 1⅛ to 1¼ in., incl.	0.013	0.009
Over 1¼ to 1⅜ in., incl.	0.014	0.010
Over 1⅜ to 1½ in., incl.	0.016	0.011
Over 1½ to 2 in., incl.	0.019	0.012

Change Section 10 to Section 11, insert the words "complete springs" after dimensions and renumber each section after this one.

DISCUSSION

C. D. Young, (Chairman): Since the writing of this report, the committee has gone over certain recommendations made by the Joint Committee of Manufacturers of Rubber Goods, and acting upon their recommendation and the data available to the committee, we would like to insert in our report, which will go to letter ballot for vote, in the paragraph relating to duck, the following additional wording:

"Section 11. Change paragraph 11 (c) to Section 12 and give it the Section heading "Duck." Omit the last section in this paragraph and insert the following:

"*11. Duck (a) Construction.*—The canvas or duck used as a wrapping for the hose shall be made from long fiber cotton and shall weigh not less than 2 oz. per lineal yard 40 in. wide. It shall have 5 threads per strand, and not less than 16 or more than 22 strands per inch of width, for both the warp and filler. The duck shall be cut and applied on a bias of from 42 to 46 deg., with edges at least 0.5 in. and both sides well frictioned.

"*(b) Specimens.*—Specimens 3 in. square and parallel to both warp and filler threads of the duck, shall be cut from the remaining 3 in. section of the hose as described in Section 9.

"*(c) Tests.*—The above described test specimens shall be pulled in a tensile machine with a test speed of 20 in. per minute, and held in M. C. B. Standard jaws (see cut) placed one in. apart, placed directly opposite each other on the center of the test specimen, and both jaws shall grip identical longitudinal threads. The specimen thus tested shall develop a tensile strength of at least 250 lb. per sq. in. of width for both warp and filler threads.

"*(d) Number of tests.*—Six tensile tests shall be made on

the duck, three on test for the warp threads and three for the filler threads.

"*(e) Rejection.*—If the average of either the three warp tests or three filler tests fails to come above 250 in per in. of width, the entire lot will be rejected. When the specimen fails in the jaws another specimen will be substituted."

This, we understand from the manufacturers, will make no change in the present duck which is being furnished under our present existing specification, but limits the manufacturers as to the number of threads in the warp and filler.

The committee found, on investigation, that some hose manufacturers were using a very low number of threads in one direction and a high number in the other, and that resulted in a decided and weak structure in one place. The weakest part of the sheet would be along either the high or low strength, and we felt, and the manufacturers believed, by balancing the strength of the warp and filler, without any increase in the cost of the duck, we will get a much stronger body for our plys in the air-brake hose.

I move that the specifications, as shown in Appendix *A*, be submitted to letter ballot as recommended practice, and that the other questions raised in items (b) to (g) and in paragraphs 1 and 2 of the committee's report, he referred to letter ballot.

F. F. Gaines, (C. of Ga.): Have these specifications been gone over with the manufacturers, so that they are specifications of which they approve? In other words, will we have to pay higher prices for the materials under these specifications than we would have to pay for an ordinary commercial article that is satisfactory and of good material? I want to be sure of that before incorporating these specifications in our rules.

Mr. Young: That is not so in all cases, except indirectly. The Society for Testing Materials is a society made up of consumers and manufacturers, and the specifications which we are offering this year are largely those which have been already accepted by the Committee on Manufacturers' Standards of the Society for Testing Materials, and in that way we have consulted the manufacturers in regard to the paint specifications. Regarding the bolt and nut specifications, these are only the tolerances practicable in the thread, proper machine work, filling out the heads and threads of bolts, and tapping the nuts. The material specification is one which the manufacturers have largely agreed to. The railway steel spring specification is the joint work of our committee and the Committee of the Manufacturers of Steel Bars. The biggest fight our committee had was to get the manufacturers to accept any rolling tolerances, etc., on steel bars, and the specifications for the rolling tolerances which we have given are the result of joint action of the M. C. B. committee with the manufacturers. The leading manufacturers have accepted this as the proper rolling specification. The other points raised in the report are not ones which would involve any matter of cost with reference to the specification.

In line with what Mr. Gaines had to say, I will state that the committee has offered these specifications as recommended practice. If the members of the association would take these specifications and get quotations on them, they would find out for themselves if there is any increase in price for the quality specified. It is not obligatory on the members to adopt the specifications, but the committee desires the members to take the specifications and find out if there is anything wrong with them. As chairman of the committee, I would like to urge on the members to try these specifications, to use them as an alternate for the present M. C. B. specification, so that we can get information from actual use. We feel, as a committee, that the materials under this specification should be better in quantity, much more uniform and can be produced at lower prices. That has been the experience of most of the members of the committee, and I think the other members of the association will find the same thing is true. Of course, the more general the specifications are used, the lower the price will become.

(Mr. Young's motion was then put to vote and carried.)

Welding of Cast-Steel Truck Side Frames and Bolsters

This is a new subject which has received the attention of a committee for the first time this year. The welding of cracked castings has been made possible by the introduction of the oxy-acetylene and electric welding processes and the practice has been extensively applied to the reclamation of bolster and side frame castings which it would otherwise be necessary to scrap. The limits which have been set in the recommendations of the committee to a large extent retain the possibilities for saving in the cost of renewals offered by the autogenous welding processes. Considering the lack of substantiating data in the report of the committee, however, the minority report condemning the practice as unsafe deserves the careful attention of all M. C. B. members.

W. O. Thompson, Chairman

W. O. Thompson, superintendent rolling stock, New York Central, is chairman. He became an apprentice on the Fort Wayne, Jackson & Saginaw, now a part of the New York Central, in 1877. He was subsequently a fireman, engineman, traveling engineer, general foreman and division superintendent motive power on the New York Central System. In July, 1907, he became master car builder at Buffalo. The other members of the committee are G. W. Rink, mechanical engineer, Central Railroad of New Jersey; J. T. Wallis, general superintendent motive power, Pennsylvania Railroad; J. J. Hennessey, master car builder, Chicago, Milwaukee & St. Paul, and A. M. McGill, assistant superintendent motive power, Lehigh Valley.

THE Committee on the Welding of Cast-steel Truck Side Frames and Bolsters desires to submit the following recommendations, one member of the committee dissenting.

Truck Side Frames.—Cast-steel truck side frames must not be welded if cracks extend more than 1 in. from edge of any rib or flange.

Bolsters.—Cast-steel truck bolsters must not be welded if cracks extend more than 1½ in. from edge of rib or flange, unless bolster is reinforced at the place of failure by the addition of plates, either welded or riveted, to bolster.

The report was signed by:—W. O. Thompson. A. M. McGill, J. J. Hennessey, and Geo, W. Rink.

MINORITY REPORT

I can not concur in the report of the majority of the committee permitting welding of cast-steel truck side frames and bolsters, as I consider the practice of welding cracks in these members, by either acetylene, electric or any other present known method, unsafe, for the reason that the fractures in-

dicate weakness in design, and the welding will not add to the strength, but introduces a condition of further weakness by improper workmanship.

It is a well-known fact that a large number of cast-steel truck side frames and bolsters, especially the former, are failing as a result of weakness in design. Where the proper sections are used, and the design proven, these cracks do not appear.

I cannot, therefore, subscribe to a practice of continuing in service such vital parts of car construction which, as evidenced by fracturing, are inherently weak, or to a method of repairs which in no way strengthens the part, but, on the contrary, introduces another chance for failure, and consequently is unsafe.

The report was signed by:—J. T. Wallis.

DISCUSSION

W. O. Thompson, (Chairman): In the committee's rather extended investigation of welding of parts of the car mentioned in the report, they have found that the art of welding not only truck frames and bolsters, but other parts of cars, and also the building up of worn parts of castings is being developed very rapidly. We believe that the recommendation made by President MacBain in his opening address in regard to this matter is a very pertinent one, namely, that a committee be appointed to investigate this rather important matter in its entirety.

F. F. Gaines, (C. of G.): I have had some tests made on oxy-acetylene welds, where the weld was shown to be stronger than the original article itself, and I think in view of the state of the art and the decreased cost to the railroad companies by the use of this process in repairing parts of cars, that the majority report of the committee should be accepted, and I therefore move that it be submitted to recommended practice.

E. S. Bilty, (C., M. & St. P.): I have seen cast side frames welded which were stronger in the weld, another portion of the frame failing. A committee should be appointed to look further into this practice and ascertain as to how the welding may be properly done. Where failures do occur in a weld, I believe it is entirely on account of improper welding. It is my opinion, however, that we should continue this practice in view of the economies presented.

C. D. Young, (Penna. Lines): The President in his report and the Chairman of the Committee feel that this is a subject which should be thoroughly investigated and a proper report made. I would like to see that prevail in preference to the motion which has been made by Mr. Gaines. Unquestionably, what Mr. Gaines has said is entirely correct, the welded parts can be made stronger, but in making them stronger it is necessary to increase the section at the point where the weld takes place. Certainly, it cannot be made stronger than the original section if made in equal sections.

There is another element which comes in in making the joint stronger at that point: there is apt to be a localized strain at a point immediately back of it, both due to the changing structure of the steel and the increase in section. Our experience has been that in welding, workmanship plays an important part in the result you will get on the weld. Ordinarily, with skilled workmanship the ductility as expressed by the elongation will be materially reduced from what you will find normally in material of the same character, although the strength might be within 80 or 90 per cent of the original strength. That is brought about largely by the fact that in making the weld the material cools very rapidly and hardens quickly, and unless it is reannealed, as the casting was originally produced, low elongation is bound to exist. It seems to me in view of the far-reaching character of such a recommendation as to submit this to letter ballot, if it were passed, would be a mistake without the subject being gone into very thoroughly by the Association.

J. J. Hennessey, (C. M. & St. P.): I agree with the recommendation made by the Chairman of the Committee. I think the subject should be thoroughly investigated. What has been said about workmanship is true, I do not know of any part of a car that cannot be spoiled by the workmanship. I do not believe that the railways of the country today are in a financial position to scrap certain material, which with a very small amount of labor and added material can be made as good as new.

It is true if you take one of the truck sides and put a torch on it, heating up a little space of about 2 in. at one point, that that would not be good workmanship. The truck side or the bolster—perhaps the truck side is the most important—should be heated at least for a distance of from 8 in. to 12 in. at the point where the weld is to be made, and in addition to that the welded portion should be cooled by covering it with ashes, as is commonly done in blacksmith shops or in the case of any welding or bonding where good work is done.

Samuel Lynn (P. & L. E.): I will emphasize what Mr. Hennessey has just said. We have for three years probably been having truck sides welded. We have not attempted to weld one of them in our own shop. The manufacturer, under contract, has welded the truck sides that have failed, under the guarantee, and also welded some truck sides that have outlived the guarantee, and the manufacturers, in addition to the welding processes, have put the truck frames into annealing furnaces. These frames, when they come back to us, are put under the cars, and we have not found one which failed after it has been welded, and in view of our experience I think that the committee should go into the matter very carefully and see what can be accomplished by the welding process.

Mr. Young: I will make an amendment to Mr. Gaines' motion—that this subject be referred to the Executive Committee, with a recommendation that the views of the Chairman prevail, and that a special committee be appointed to investigate the subject and determine the possibilities and limitations of this practice with reference to truck sides and bolsters. That if welding is to be permitted that certain specific instructions shall be framed, as to how the work shall be performed in order to produce the result desired to bring the structure up to a proper condition for service.

C. F. Giles, (L. & N.): In view of the fact that some of our connections have instructed their inspectors to reject cars with truck sides and bolsters which have been welded, I think we should have some understanding as to what the practice should be pending a settlement of this question.

Mr. Gaines: I am perfectly willing to accept Mr. Young's amendment to my motion, but I think we should be allowed to continue our present practice until the committee has described some proper method, and the association recommends its adoption. In the meanwhile, I think the Committee's original report should stand.

D. F. Crawford, (Penna. Lines): What difference would it make in the acceptance of cars whether the majority committee report stood or did not stand? In the code of Interchange Rules the receiving line has the right to determine what is safe or unsafe for transportation over its lines, and I do not think any action can be taken by the convention that will make obligatory the receiving of cars by a line that does not wish to receive them, with the welded side frames or any other defect. Therefore, it seems to me that when there is a minority report on such a subject and so much question as to safety involved, that we can well wait until another convention for some specific directions that can be embodied in the Code of Interchange Rules.

Mr. Gaines' motion, with Mr. Young's amendment, was put to a vote and carried.

NEW BUSINESS

F. W. Brazier, (N. Y. C.): With the Draft Gear Committee working on the details of the rear attachments of the coupler, and the work of the Coupler Committee nearing completion as to the adoption of a standard coupler, it would seem to be in order to give consideration to the methods used for connecting the coupler and the rear attachments. The cast steel coupler yoke has been in use for several years and it would be possible to obtain information as to the relative merits of the two methods of attaching the coupler and its rear attachments. I would therefore move that the incoming Executive Committee be requested to consider the assigning of such a study to a special committee with a view to improving the conditions in connection with this detail of car construction—the cast steel coupler yoke with slot bar connections as compared to the riveted coupler yoke.

Mr. Crawford: I second the motion.

(The motion was carried.)

E. W. Pratt (C. & N. W.): I move that this Association invite the Air Brake Association to send a representative or a committee, as best pleases them, to the conventions of this Association. It has been brought out in connection with the presentation, particularly, of the air brake committee report, that it is desirable for us to obtain their co-operation and help.

(Mr. Wildin seconded the motion, which was put to vote and carried.)

C. D. Young (Penna. Lines): In the presentation of the committee report on Brake Shoes and Brake Beams, Mr. Smith offered a discussion on the plates, as shown by the brake beam committee, in connection with the lever situation, and the bottom connection on freight car trucks. We have plates covering these constructions at the present time, and the construction as shown by the committee, is the same as that shown by the Association. The points raised by Mr. Smith I believe are very well taken, and it seems to me that following the discussion of Mr. Cromwell, that sometimes the bottom connection can get down on the track. I think, perhaps, that is also a subject that needs some further investigation.

I believe that the Executive Committee could give this matter some consideration with a view of appointing a special committee to review thoroughly the matter of brake connections in connection with the 50 and 70-ton truck, both for the truck and the body rigging of freight cars. Recent investigations by our department have shown that the release in some of the body rigging in freight cars is very poor, and results in dragging brake shoes and in increased train resistance. I move that the matter be referred to the Executive Committee.

(The motion was seconded by Mr. Goodnow, put to vote and duly carried.)

The President: It has been customary in the past, during the interim between the finishing of the regular business and the report of the tellers on election, that we have a sort of experience meeting.

F. W. Brazier, (N. Y. C.): I think these occasions are very good. I want to say something to the younger man of the character of John Kirby, who was so nicely referred to by the president. In looking over the list of members, you would be surprised to learn that there are only nine members, including the life members, who have been connected with the association for over 30 years. J. T. Chamberlain has been a member of the association for 33 years, J. W. Marvin, 40 years; William McWood, who I have been told is on his death-bed, being 87 years old, has been a member of the association for 41 years; J. D. McIlwain has been a member for 43 years, George Hackett has been a member for 46 years. I think that Mr. Hackett is a master mechanic on the Philadelphia & Reading. John Kirby, who passed away last year, had been a member of the association for 44 years. Those gentlemen whom I have just named were life members of the association. In the list of active members there are only three who have been connected with the association 30 years and over—E. D. Nelson has been a member for 31 years, George Rommel for 34 years, and last, but not least, the man we all love, honor and respect, the man who has been in railroad service for over 50 years, whom we will always look to with affection and pride, John S. Lentz, the treasurer of the association, has been a member for 37 years. He is a man who can be taken as an example by our younger members. Unfortunately, I have been a member of the association for but a little over twenty years. I had the privilege of attending the meetings of the association before I took an active part in its affairs. I honor the young men, and I hope they will emulate the principles and character of those like Mr. Barr, Mr. Rhodes, Mr. Marden, and others of our members in the earlier days. Years ago it was a great pleasure to see them take part in the convention proceedings. They were the bright lights in the car department. There are very few of the old-time car men left. The mechanical departments are fast being placed under one head, as Superintendent of Motive Power, or some similar title, which, no doubt, is the proper thing for the railroad to do; but in the case of those who remain and are representatives of the car department, let us stand up and show our colors and say that we will try to emulate the principles and character of these men referred to.

There is one other man I want to refer to, Mr. Manchester. We all respect Mr. Manchester. He has been in actual railroad service for over 50 years, in the service of the Chicago, Milwaukee & St. Paul. Are not these men grand monuments to guide us in an association of this character?

ELECTION OF OFFICERS

The following officers were elected: President, C. E. Chambers, superintendent motive power, Central Railroad of New Jersey; first vice-president, T. W. Demarest, superintendent motive power, Pennsylvania Lines West, Northwest System; second vice-president, James Coleman, superintendent car department, Grand Trunk; third vice-president, G. W. Wildin, mechanical superintendent, New York, New Haven & Hartford; treasurer, John S. Lentz, master car builder, Lehigh Valley.

The following were elected members of the executive committee: Samuel Lynn, master car builder, Pittsburgh & Lake Erie; J. C. Fritts, master car builder, Delaware, Lackawanna & Western, and C. B. Young, mechanical engineer, Chicago, Burlington & Quincy.

The election of members for the nominating committee resulted in the selection of F. W. Brazier, superintendent rolling stock, New York Central Lines; D. F. Crawford, general superintendent motive power, Pennsylvania Lines West; D. R. MacBain, superintendent motive power, New York Central Lines West of Buffalo; C. E. Fuller, superintendent motive power, Union Pacific, and M. K. Barnum, superintendent motive power, Baltimore & Ohio.

George N. Dow was elected life member. Mr. MacBain was presented with a past-president's badge by Mr. Hennessey for the association.

A BIG EXHIBIT

The officers of the Railway Supply Manufacturers' Association are very much delighted with the size of the exhibit this year. In spite of the fact that a large percentage of the machine tool builders were unable to participate because of their inability to spare tools for exhibit purposes, 76,431 sq ft. of exhibit space has been taken, as compared with 70,412 sq. ft. last year, an increase of over 6,000 sq. ft. Up to Thursday evening 412 company membership badges had been taken out, an increase of two over last year, with a promise of several more before the convention closed.

LITTLE INTERVIEWS

L. F. Loree, president of the Delaware & Hudson, chairman of the Kansas City Southern, and for years one of the leading railway executives of the United States, was an interested visitor at the M. C. B. convention and among the exhibits yesterday. Accompanied by Mrs. Loree and their daughter, Miss Louise, Mr. Loree motored down from New York. The party will be here until Monday.

Mr. Loree, while he long has been an executive officer, was educated as an engineer, both civil and mechanical, and always has taken a keen and active interest in engineering matters. He is, therefore, peculiarly equipped by his knowledge of engineering matters, and his experience as a railway manager, to judge of the value of such an exhibit of railway appliances as that on the Pier. Discussing this subject, Mr. Loree said yesterday:

"I have gone over a large part of the exhibit, and noted the railway men who have been inspecting them, and their attitude toward them, and in doing so have confirmed the impression I long have had, that the conventions here, and the exhibit in connection with them are of great value to the railways of this country. I believe railway executive officers generally, and the railways that they are on, would benefit if they came here and looked over this exhibit.

"The conditions are peculiarly favorable here for deriving the maximum benefit from what is shown. At any ordinary exposition of a general character the machinery and devices of any particular kind are merely a small part of a large whole, and there is not what Frank Thomson used to call the right 'atmosphere' in which to study them. The 'atmosphere,' in this sense, is favorable here, and, furthermore, the supply companies have here the best experts available to explain to visitors.

"I have taken much interest in noting the attitude of the railway men toward these exhibits. In going about I have found them everywhere on the Pier, and they show they realize that they are here for the serious and important purpose of getting information and ideas that will be of value to their companies. The exhibit is a great educational institution."

Mr. Loree expects to go from here to Washington, D. C.

George Hodges, of Chicago, who recently succeeded Arthur Hale as permanent chairman of several important committees of the American Railway Association, and who retains also his former position as secretary of the Committee on Relations of Railway Operation to Legislation, is attending the conventions. Mr. Hodges is now chairman of the committees of the American Railway Association on Relations Between Railroads; on Arbitration Under the Per Diem Rules Agreement; on Marking, Packing and Handling of Freight; on Weighing, and on Legal and Traffic Relations. He has recently appointed R. M. Patterson, formerly general superintendent of freight transportation of the Pennsylvania Railroad, as his assistant. In an interview Wednesday, Mr. Hodges urged upon the attention of the railroads the importance of taking prompt action to expedite the equipping of their cars in such a manner as to comply with the provisions of the United States safety appliances laws.

"The present requirements regarding safety appliances on equipment were adopted by Congress in 1910," said Mr. Hodges, "and went into effect on July 1, 1911. The Interstate Commerce Commission, under the discretionary authority conferred on it, specified the appliances to be used, and gave the roads five years to adopt them. There subsequently was secured another extension of a year, or to July 1, 1917. It is desirable for it to be generally understood by the railway officers directly concerned that it seems extremely improbable that any further extension of time can be secured from the Commission. If this should prove to be the case, the attempt, after July 1, 1917, to use equipment not equipped as required, would become punishable with all the penalties of the law. It is, therefore necessary that the railways should adopt promptly strong measures to hasten the equipping of cars that are not properly equipped. There are at present about a half million such cars in the United States. It will be noted that the penalties apply, not to the owner of a car, but to the railway which uses it in interstate commence. It would be unnecessarily expensive for roads to equip foreign cars which happen to be on their lines after the law finally goes into effect, because they would not have the needed tracings, blue prints, etc. To deal with the situation it has been proposed that a rule should be adopted providing that after January 1, 1917, no car not properly equipped will be received by any other road from its owner, and that after April 1, 1917, no such car shall be received by any road from any other road in interchange. This rule ought to be adopted, to insure compliance with the law, and for the protection of the roads which do promptly comply with it against those who may not do so. Unless something of this kind is done, many cars which are not properly equipped may be off the home lines when the law goes into effect, with the result that a lot of unnecessary expense will be imposed unfairly on the roads on whose lines they happen to be."

Mr. Hodges has been connected with the work of the American Railway Association for a long time, and was for several years assistant general agent.

"A most remarkable organization," Mr. Brandeis is reported to have said of the Southern Pine Association. This association, made up of about 200 members, supplies its subscribers with information as to things of benefit to their industry and maintains an inspection bureau and laboratories. It also arranges for the publication of information which will benefit the industry generally.

Interviewed as to the objects of the association, Dr. Herman Von Schrenk, who is acting for it in the capacity of consulting engineer, said: "The pine manufacturers have been unfortunate in that they have never come into as direct a relationship with the railroads who use their material as is desirable, and therefore did not have as thorough an understanding as to their requirements as should have been the case. Likewise many railroad officers are not informed as to the manufacturers' methods and facilities. This is indicated," he said, "by the fact that only one lumber manufacturer is represented in the membership of the Railway Supply Manufacturers' Association, although lumber forms a very large proportion of the material purchased by railroads. The Southern Pine Association had an exhibit at the Railway Engineering exhibit in Chicago last winter and this is the first time it has exhibited at the Atlantic City conventions.

"There is 393,000,000,000 feet of good yellow pine in the South. The manufacturers of yellow pine want to get into direct touch with the railroads in order to find exactly what grades of material they need for various purposes. The available supply of yellow pine is such that any of their requirements can be filled if they are known. It is not the intention to advocate the replacing of steel with wood where the former product can be used to better advantage. There are many places, however, where wood can be used to as good or better advantage than steel, and the manufacturers want to get into close relationship with the railroads in order that they may find out exactly what their needs are and meet them satisfactorily."

GOING SOME

It has been customary for many years to hold meetings of the executive committee each day during the conventions to discuss any problems or complaints that may have come up. Yesterday—the first time in years—there was nothing to bring before the committee, and the meeting was called off. Congratulations to those in charge.

BASEBALL TODAY

Baseball bugs and other lovers of outdoor sport, attention! Sharply at 2 P. M. the parade will form at the entrance to Young's Million Dollar Pier and, headed by the competing teams, will start up the Boardwalk to South Carolina Avenue, where cars will be waiting to carry the crowd to the ball park. Particular attention is called to the fact that the game will be played at "City Park" at the Inlet and NOT Inlet Park.

Those who desire to do so or are too late to get into the parade can reach the park direct by taking any east-bound car on Atlantic Avenue. Take cross-town cars from the Boardwalk at South Carolina or Virginia Avenues to Atlantic. Admission to the grounds will be by badge only.

The game will be called promptly at 3.30 P. M., when it is expected a large crowd will be in attendance. The entertainment committee has arranged to distribute pennants. The batting order is as follows:

MASTER MECHANICS	MASTER CAR BUILDERS
W. D. Arter, s. s., N. Y. C.	
H. Fuller, r. f., U. Pac.	Bert Robinson, c., Erie.
H. C. May, 1st b. (capt.), L. V.	S. Rigling, 1st b. (capt.), Penn.
W. K. Campbell, 2d b., N. Y. C.	B. F. Goodman, r. f., B. & O.
E. G. Chenoweth, l. f., C. R. I. & P.	E. Kelsh, s. s., Erie.
G. F. Laughlin, 3d b., A. Car Lines	C. S. Schwartz, c. f., St. L. R.
G. Durham, c. f., D. L. & W.	R. C. Merritt, 3r B., Erie.
J. Dugan, p., N. Y. C.	F. J. Mueller, 2d b., B. & O.
J. Schleh, c., N. Y. C.	G. R. Kreider, l. f., Penn.
M. C. M. Hatch, mgr., D. L. & W.	T. Padgett, p., Erie.
	Utility
	W. L. Wilt, Penn.
	J. W. Senger, N. Y. C.

LAST NIGHT'S CARNIVAL DANCE

At 10.30 o'clock last night the Entertainment Committee estimated the number of the dancers at the Carnival dancing party to be even greater, in spite of the wretched weather conditions, than on the previous night at the M. C. B. ball, so it must have been the Carnival features and festivities that attracted the merry throng. The Entertainment Committee had liberally provided the latest fancy hats and caps, streamers, balloons, whistles and all manner and kind of jimcracks. The dancing and fun making was kept up until a late hour.

The committee in charge was as follows: Miss A. Gertrude Hogan, chairman; Mrs. D. R. MacBain, Mrs. E. W. Pratt, Mrs. B. P. Flory, Mrs. C. Fuller, Mrs. T. Goodnow and Mrs. E. R. Hibbard.

ADDITIONAL MASTER CAR BUILDERS' REGISTRATION

Andrews, S. B., Mech. Eng.; S. A. L.; Shelburne.
Deems, W. A., M. M.; Stat. Isl. & R. T.; Blenheim.
Graburn, A. L., Ass't S. R. S.; Can. Nor. Ry.; Blenheim.
Myers, H. E., M. M.; L. V.; Dennis.
Mussey, Wm. H., A. E. M. P.; Long Island; Haddon Hall.
Pendleton, Ed., C. I. I.; P. & P. U. Ter.; Netherland.
Pfahler, F. P., M. P. I.; B. & O.; Arlington.
Porter, C. D., A. E. M. P.; Penna.; Blenheim.
Robb, Geo. W., S. M. P.; Gd. Tk. Pac.; Blenheim.
Schwartz, C. L., A. G. M.; St. L. Refr. Car Co.; Alamac.
Seifert, S. P., S. C. D.; N. & W.
Sugg, Chas. R., E. E.; At. C. L.
Wallace, L. W., Prof. Ry. & Ind. M.; Purdue Univ.; Chalfonte.
Young, C. B., M. E.; C. B. & I.; Traymore.

ADDITIONAL MASTER MECHANICS' REGISTRATION

Allison, W. L., V. P.; Amer. Arch Co.; Blenheim.
Averill, E. A.; Traymore.
Ayers, A. R., Eng. Roll. Stock; N. Y. C.; Blenheim.
Barclay, F. B., S. M. P.; Ill. Cent.; Shelburne.
Barnum, M. K., S. M. P.; B. & O.; Dennis.
Barrett, C. D., A. E. M. P.; Penna.; Brighton.
Barry, Frank J., M. M.; N. Y., O. & W.; Chalfonte.
Bartlett, Henry, G. S. M. P.; B. & M.; Blenheim.
Black, W. G., M. M.; N. Y. C. & St. L.; Chester Inn.
Borell, Elmer A., Eng. M. P.; P. & R.; Albemarle.
Breyer, J. S., M. M.; So. Ry.; Traymore.
Brown, M. G., M. M.; W. & T. R. R.; Penn Hall.
Chambers, C. E., S. M. P.; C. of N. J.; Dennis.
Clark, F. H., G. S. M. P.; B. & O.; Blenheim.
Coutant, M. R., M. M.; U. & D.; Shelburne.
Crawford, C. H., A. E. M. D.; N. C. & St. L.; Blenheim.
Cromwell, O. C., M. E.; B. & O.; Chalfonte.
Crownover, G. M., M. M.; Chgo. Gt. West.; Dennis.
Darlow, A. M., S. M. P.; B. & S.; Chalfonte.
Dice, A. T., Jr., G. I.; P. & R.
Dillon, S. J., M. M.; Penna.
Duffey, G. J., M. M.; L. E. & W.; Chalfonte.
Elmer, Wm., S. M. P.; Penna. R. R.; Traymore.
Ettenger, R. L., C. M. E.; M. & O.; Dennis.
Ewald, Wm., S. M. P.; Cum. & Pa.; Ebbitt House.
Ewing, J. J., Mech. Eng.; C. & O.; Alamac.
Fitzmorris, James, M. M.; Chgo. Jct.; Lexington.
Flanagan, M., M. M.; C. & O.; Blenheim.
Fowler, Geo. L.; Dennis.
Freeman, L. D., S. S.; S. A. L.; Kenderton.
Fritts, J. C., M. C. B.; D. L. & W.; Traymore.
Fry, Lawford H.; Std. Steel Wks.; Shelburne.
Gibbs, A. W., Ch. Mech. Eng.; Penna.; Chelsea.
Goodrich, Max, M. M.; N. Y. C.; New Holland.
Gould, Jos. E., M. M.; C. H. & N.; Dennis.
Gould, J. R., S. M. P.; C. & O.; Shelburne.
Graburn, A. L., Ass't S. R. S.; Can. North. Ry.; Blenheim.

ADDITIONAL SPECIAL GUESTS

Allman, W. N.; B. & O.; Arlington.
Baldwin, T. C.; M. M.; N. Y. C. & St. L.; Pennhurst.
Beahm, P., Mach. Helper; Penna.
Bigelow, E. F., G. I. C. D.; N. Y. C.; Breakers.
Bixler, H. C., Supt. Sta. & Tr.; Penna.; Seaside.
Boyer, S. W.; Penna. T. Car Co.; Haddon Hall.
Brigham, Edmund D., Jr., Supt. Trans.; A. S. Desp.
Burton, R. B., Ass't to Cons. Egr.; So. Pac.; Shelburne.
Butt, F. W.; N. Y. C. R. R.
Caples, M. J., Vice Pres.; C. & O.
Coan, Michael, F. C. I.; P. & R.; Monticello.
Corning, C. W., Ch. Smoke Insp.; C. & N. W.
Cromwell, H. C.; B. & O.; Arlington.
Cromwell, H. T., G. I. L. & T.; B. & O.; Chalfonte.
Cromwell, J. E., S. I.; B. & O.; Arlington.
Demarest, Geo. F., G. F.; Cent. N. J.; Jackson.
Drayer, M. S., Dftsn.; Penna.
Eliot, H. H., Asst. M. M.; Phila., Balt. & Wash.
Ewing, J. J., M. E.; C. & O.; Alamac.
Fechtig, F. H., Pur. Agt.; A. C. L.; Chelsea.
Gibboney, E. S., Fore.; H. & B. T.; Howard.
Grantner, L. V., Dist. M. P.; B. & O.; Traymore.
Griswold, W. W., Pur. Agt.; W. & L. E.; Blenheim.
Hertzler, S. M., Sp. Eng.; Penna.; Lyric.
Hitz, Chas. D., Pur. Dept.; P. R. R.
Hodges, George, Ch. Am. Ry. Ass'ns; Brighton.
Holst, E. W., Mech. Engr.; Bay State St. Ry.; Blenheim.
Holzemer, J. F., P. A.; T. & O. C.; Haddon Hall.
Hukill, H. O., Ret. Pur. Agt.; Penna. Lines West; Brighton.
Lacy, H. S., Storekpr.; S. A. L.
Lancaster, W. C., Elec. Engr.; Can. No.; Blenheim.
Lane, R. H., I. T. Dept.; So.
Little, D. A., M. P.; P. R. R.; Breakers.
Ludy, L. V., Prof. Exp. Eng.; Univ. Perdue; Chalfonte.
Merrill, A. J., Sec.; So. & Southwest. Ry. Club; Dennis.
Miller, B. E., M. P.; D., L. & W.; Alamac.
Montague, W. T., Ass't M. M.; Penna.; Brighton.
Munro, D. A., P. A.; Second Ave. R. R.
Norton, A. W., Dftsn.; B. & O.; Arlington.
Patton, C. S., M. M.; S. A. L.; Alamac.
Pearce, H. C., Gen. Pur. Agt.; S. A. L.; Blenheim.
Prendergast, J. F., M. M.; East Bd. Top R. R.; Chalfonte.
Randolph, Q. S., Dean Dept. Eng.; Virg. Poly.; Seaside.
Shaffer, M. L., Fore.; Penna.; Brighton.
Shand, Alexander C., Ch. Engr.; Penna.; Haddon Hall.
Sharpley, J. E., Ch. Elec.; Virginian; Arlington.
Shipley, W. R., F. B. S.; West. Mryld.
Simon, Wm., Tk. Gear Gger.; West. Weigh. & Insp. Bu.
Smith, M. E., Sig. Eng.; D., L. & W.; Traymore.
Spengler, E. A., Ass't R. F. E.; Penna.; Bowkers.
Stapleton, J. F., Cl. Pur. Dept.; N. Y., N. H. & H.
Steinmeyer, Chas. S., Eng. M. of W.; M. Con.; Chalfonte.
Stewart, L., F. C. S.; P. & R.; Silverdale.
Strauss, I. H., Sec. to S. M. P.; C. & O.; Shelburne.
Tarback, F. S., Fore.; B. & O.; Widdle.
Taylor, F. C., Ass't C. C. I.; Penna.
Topping, Walter S., Ass't Ch. Insp.; Bu. of Exp.; Alamac.
Walsh, Charles E., Ass't Pur. Agt.; Pa. Lines West; Brighton.
Wertz, Cyrus, M. P.; P. & R.; Risley.
Woods, M. D., Traf. Mgr.; Crew Levick Co.
Yoder, James H., F. C. S.; P. & R.; Silverdale.
Ziegler, E. J., Ch. Elec.; Fda. East Coast; Sterling.

CO-OPERATION WITH THE AIR BRAKE ASSOCIATION

The joint meeting of the Train Brake and Train Air Signal Committee of the M. C. B. Association and the Executive Committee of the Air Brake Association was held at the Marlborough-Blenheim, on Thursday, June 15, at which arrangements were perfected whereby the M. C. B. committee is assured of every possible assistance from the Air Brake Association. In return, the committee commends to the M. C. B. Association and to its individual membership the bestowal of such encouragement and good will on the Air Brake Association as will enable it to assume the additional burdens entrusted to it by the M. C. B. Association.

THE NEW VICE-PRESIDENTS

At the final session of the Master Car Builders' convention James Coleman, superintendent of the car department of the Grand Trunk, and G. W. Wildin, mechanical superintendent, New York, New Haven & Hartford, were elected vice-presidents. Mr. Coleman has been for some time a member of the Arbitration Committee. He has had an extended experience in car work, and is recognized as an authority on car department matters. He is a capable executive officer and holds the high respect and esteem of those under him and all who come in contact with him. His recognized ability as an executive and his wide knowledge of car practice have made him a man whose opinions have been widely sought. Mr. Coleman was born in Port Huron, Mich., and started work with the Grand Trunk as an apprentice in the car department in 1873. He has been with the Grand Trunk and its affiliated lines practically ever since. He worked at Port Huron until 1889, when he was appointed foreman at Chicago, remaining in that position until 1899, when he went to the Central Vermont, at St. Albans, Vt., as master car builder. In 1905 he went to Montreal to organize the manufacturing department of the Canada Car Company, now the Canadian Car & Foundry Company, and in 1906 returned to the Central Vermont to his former position. In January, 1908, he succeeded W. McWood as superintendent of the car department of the Grand Trunk, with headquarters at Montreal, Mr. McWood retiring on pension at that time. Mr. Coleman has held the position of superintendent of the car department of the Grand Trunk ever since.

George W. Wildin is a past president of the American Railway Master Mechanics' Association and is widely known and highly esteemed among railway men throughout the country. He has been in charge of mechanical matters on the New Haven for a number of years, his duties including the supervision of both steam and electric locomotive equipment, as well as the entire car department. His railroad experience has been thorough and extensive, and he has most creditably assisted in carrying the New Haven through the trying period of the past few years. Mr. Wildin was born on February 28, 1870, at Decatur, Ill., and was graduated from the Kansas State Agricultural College in June, 1892, with degree of B. S. He entered railway service in 1892, as mechanical draftsman in the Topeka shops of the Atchison, Topeka & Santa Fe, since which he has been consecutively machinist and locomotive fireman on the same road; locomotive engineer, Mexican Central; superintendent, Aermotor Company, Chicago; locomotive engineer, Chicago & Alton; machinist, Plant System (now part of the Atlantic Coast Line), at Savannah, Ga.; locomotive and car inspector, and mechanical engineer, same system; April 1, 1901, to March 1, 1904, mechanical engineer, Central of New Jersey; March 1, to April, 1904, assistant mechanical superintendent, Erie Railroad; April 1, 1904, to January 1, 1907, mechanical superintendent of the Erie at Meadville, Pa.; January to July, 1907, assistant superintendent motive power, Lehigh Valley; and July, 1907, to date, mechanical superintendent, New York, New Haven & Hartford, at New Haven, Conn.

Conventionalities

Umpire Frank Edmonds arrived Friday carrying a case said to contain bomb proof armour.

Mr. and Mrs. Charles D. Jenks, Chicago, are at the Dennis. Their guests are Mrs. Fred Poor and daughters, Betty and Natalie, also of Chicago.

The party of C. E. Fuller, superintendent of motive power and machinery of the Union Pacific, at the conventions consists of Mrs. Fuller, their son, Charles Edward, and their daughter, Miss Mary.

T. H. Goodnow says *The Daily* must think he is about 60 years old. We said yesterday that he went to work on the Lake Shore & Michigan in 1881, whereas the correct year was 1889. We hereby offer our humble apology, although, really, Mr. Goodnow hasn't even approached the age yet when he need be sensitive on the subject.

Mr. and Mrs. Charles M. Woods arrived from New York on Friday, and are mingling with the convention visitors. Mr. Woods, who is now assistant manager of the Biltmore hotel in New York, is well known among those who attend the conventions, he having for five years been connected with the Chalfonte in Atlantic City. After leaving here he was at the Vanderbilt in New York one year. He has always made it a point to return to Atlantic City during the weeks of the mechanical conventions.

The Interstate Commerce Commission is, as usual, well represented at the conventions this year. Secretary George B. McGinty arrived on Thursday evening, and has been meeting old friends and inspecting the exhibits. Frank McManamy, chief inspector of locomotive boilers, also arrived Friday, accompanied by Alonzo G. Pack, assistant chief inspector. Garland P. Robinson, the other assistant chief inspector, and Mrs Robinson already were here. All of these representatives of the commission have many freinds among the convention visitors who are always glad to greet them.

E. S. Wortham, formerly a well-known western railroad man and a crack golfer of the Glen View Club, of Chicago, accompanied by Mrs. Wortham, is a guest at the Traymore. Mr. Wortham's many friends are calling this visit to Atlantic City a honeymoon trip; but they are wrong, so wrong, because it happened long ago—at least three or four months ago. Mr. Wortham's golf game has improved to such an extent lately that ever since he recently chased a ball into the woods and got a good dose of poison ivy he has been known as a "scratch" man. (N. B.) Hoover Bankard, Ned Sawyer, Lu Sherman, and the other members of the golf commitee, should make a note of this and watch out for Brother Wortham's registered handicap.

C. B. Young, mechanical engineer of the Chicago, Burlington & Quincy, is telling his friends this year of the new interior finish for the Burlington's all-steel diners. That road has developed a system whereby wall paper, the same as used in a house, may be applied to the steel lining of the cars, giving a much more agreeable and homelike atmosphere to them. The first car to be so decorated runs between Chicago and Savannah on the Minnesota Limited, one of the Burlington's crack trains. A straw vote of the passengers was taken when the car was first placed in service and the system was unanimously declared to add greatly to the appearance of the car. A special paper is used over which a coat of white varnish is applied for the protection of the paper. All the steel diners of that road are to be so finished, each to have paper of a different design.

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THE RAILWAY AGE GAZETTE is a member of the Audit Bureau of Circulations.

Co-operation with the Air Brake Association

The Air Brake Association is one of the railway mechanical associations which has been doing exceptionally good work. Many of the practices which have been adopted by the Master Mechanics' Association originated largely through the efforts of the Air Brake Association and it will be remembered that President Crawford in his address to the Master Car Builders' Association last year suggested the desirability of closer co-operation between the two organizations It is therefore gratifying to learn that the M. C. B. committee on Train Brakes and Train Air Signals has taken definite action with the Executive Committee of the Air Brake Association to provide closer co-operation between the two associations. There is no doubt that with its membership of air brake experts the Air Brake Association can be of the greatest help to the Committee in determining on the best air brake practices, as well as preventing the adoption of practices which are not desirable.

Advance Copies of Convention Reports

Members of the Master Mechanics' Association have commented with much appreciation on the early receipt of the advance copies of the committee reports. It has given them plenty of time thoroughly to study the reports and they are better able to discuss them comprehensively. The reason for this good record is the fact that the Executive Committee of the association voted to set April 1 as the latest date at which reports would be received from the committees. Secretary Taylor sent out follow-up letters for three months before that time calling the attention of the chairmen of the committees to this ruling of the Executive Committee. As a result, every report was in before April 1, and the reports were printed and in the hands of the members several weeks before the meeting of the convention. This also had its effect on the Master Car Builders' Association, the reports of that association coming in earlier than they have in previous years. It is a splendid plan to follow, and it is hoped that the Executive Committees of both the Master Mechanics' and Master Car Builders' Associations will follow the practice next year.

Locomotive Orders in 1916

The most striking feature about the equipment market for the last six months has been the sustained buying of locomotives. The high prices of steel have hindered the buying of cars to some extent, as has been shown by the withdrawal of several inquiries and by the fact that freight car orders, while much above those of last year, are not quite up to normal. High prices of steel have also undoubtedly checked the buying of locomotives, for a number of important inquiries have had to be abandoned. The orders for locomotives, however, have been holding up exceedingly well. The orders reported from the first of January, 1916, to June 10, are already in excess of those for the entire 12 months of 1915, this year's orders thus far totaling 1,692, as compared with 1,573 for all 1915. The large buying of locomotives last year was confined almost exclusively to the last three months. The result is that the 1,692 locomotives ordered this year compare with only 365 ordered in the same period last year, or that orders this year are over 4½ times as great. The table herewith gives a comparison of the orders by months:

	1916	1915
January	231	31
February	272	36
March	634	114
April	178	20
May	248	101
June (first half)	129	63
Total	1,692	365

These figures do not include the orders for export. There have been orders reported for 392 locomotives, mostly small engines, for foreign countries, exclusive of an order for 350 gasoline trench engines for the Russian Government. This export figure may be doubled at any time now, for the Russian Government has recently issued inquiries for from 600 to 1,000 Decapod (2-10-0) type locomotives similar to those ordered about this time last year.

Increases in Degree of Superheat

It has been apparent during the past year that railroad men have been quite seriously considering the advisability of using higher steam temperatures in order to obtain results in fuel economy even better than are being realized from present superheater engines. Their thoughts have naturally taken the direction of comparing the advantages resulting from the increase in steam pressures during the past fifteen to twenty years with advantages and economies to be obtained from increasing the amount of superheat. Some American roads are even now operating quite successfully superheater locomotives using steam at 700 deg. F. and 750 deg. F., total temperature, with remarkably low steam and fuel rates, while 800 deg. F. is quite common in Europe. Undoubtedly it will be some time before the average of steam temperatures in this country reaches these figures, but the tendency is in this direction. At a recent meeting of the Central Railway Club, this question was discussed and the fact brought out that an increase of approximately 50 deg. in superheat resulted in 10 per cent reduction in fuel consumption per unit of power output, and at the same time in an increased capacity of the locomotive. The higher exhaust steam temperature which

goes along with higher initial superheat is liable to prove misleading, in that it may produce the belief that such conditions are accompanied by greater heat losses in the exhaust; but it must be remembered that the quantity of exhaust steam. as well as its temperature, must be considered in determining the heat loss. As the degree of superheat increases, the quantity of steam passing through the cylinders decreases, which accounts for a decreased heat loss in the exhaust with higher initial superheat. Along with higher steam temperatures there must be considered the questions of packing and lubrication of pistons, valves and rods. It is quite reasonable to suppose, however, that the designs which have successfully cared for 200 deg. and in some cases 300 deg. of superheat would, with slight, if any modification, be satisfactory with another 50 to 100 deg. It would be profitable if some light on this subject, and a free discussion of it, followed the presentation of the report of the Committee on Superheater Locomotives.

The Dimensions of Boiler Tubes

So far as we know one American railroad, the Pennsylvania, has investigated the matter of the relation of boiler tube length and diameter. Among railway men in general, however, there seems to be too little idea of what the best relation between these dimensions should be. In fact, it is doubtful if there is any authoritative data on this subject aside from what the Pennsylvania Railroad has developed for use on its own locomotives. It seems as if locomotive builders had developed the boiler largely by increasing the length between tube sheets and retaining the old dimensions for the tubes, but is it not probable that there is some fairly definite relation between the length and either the diameter or the cross sectional area which will give the best all round results from an efficiency standpoint? The general use of the superheater with its large diameter flues adds to the desirability of some definite knowledge on this subject. If we look over these dimensions for the tubes of a number of locomotives considerable differences are apparent and it is evident that if some of the arrangements are right others cannot be. Considering the constantly increasing demands on the locomotive boiler and the necessity of its efficiently producing every possible pound of steam, it would seem a matter of importance that a comprehensive investigation of this subject be undertaken. Would not this be a suitable subject for investigation by a committee of the American Railway Master Mechanics' Association?

The Character of Committee Reports

We have from time to time directed the attention of the members of the two associations to committee reports which we consider particularly commendable. Examples of such reports which might be mentioned are those of the Coupler Committee and the Committee on Specifications and Tests of Materials. Unfortunately all of the committee work is not of the same high character; too much of it bears evidence of having been left to be carried out by the chairman alone. This is poor practice and is not fair to either the chairman or the association as a whole. Perhaps in some cases the chairman is himself to blame for such a condition; but the committee members should all take an active part in the committee's work and the discussions at its meetings so that when a report is presented it will be the views of the committee as a whole and not merely those of the chairman with the signatures of the other members added. There has also been too much of the practice of rounding up material by sending out circular letters and condensing the replies into a report. If the committee work is worth doing at all it is worth doing well and there should be original work done in all cases instead of following the practice of learning what most roads do and then recommending its adoption. Unfortunately it cannot be said that all of the committee work is worth doing, but this is a condition which should be very easy to remedy as there are enough matters of importance which should receive consideration by the associations to provide a plentiful supply of high grade subjects for committee work.

TRAIN EMPLOYEES TO TAKE STRIKE VOTE

THE expected has happened, and, as announced in *The Daily* of yesterday, the conference in New York between the National Conference Committee of Managers and committees representing the brotherhoods of train service employees, has been broken off, and the representatives of the brotherhoods have gone out to take a strike vote. The developments which immediately preceded the termination of the conference were as remarkable as was the holding of the conference itself. The conference Committee of Managers offered to submit the points in controversy to arbitration either by the Interstate Commerce Commission or under the Newlands act. This is the first time such an offer ever was made before a strike vote had been taken. The representatives of the employees promptly rejected either form of arbitration.

The merits of the situation now presented are so obvious that the public should have no difficulty in understanding them. The men in train service started in by presenting demands that are a complete subterfuge. They pretended that they were seeking an eight-hour day. Their proposals showed on their face that they contemplated a large increase in wages. The railways pointed out that this was the case, and the spokesmen of the employees at first denied it, saying that all they were asking for was an eight-hour day, and that this could be granted without an increase of expenses. The railways estimated the increase in wages which would result at $100,000,000, and the employees now finally have conceded that to comply with their demands would cost $25,000,000 a year. This is just $25,000,000 more than they at first admitted it would cost, while the detail figures which the railways have compiled based on recent pay rolls show that the original estimate of $100,000,000 was not exaggerated.

Having begun with a bald attempt to mislead the public as to what they were seeking, the leaders of the brotherhoods have contended to pursue similar tactics. They have carried on a campaign of publicity which has consisted largely of blackguarding the managements of the railways and issuing glaring misstatements as to the facts regarding the railway situation. They have met the proposal of the railways for arbitration either under the Newlands law, which these same employees helped to get passed, or by the Interstate Commerce Commission, the body that regulates the rates from which all wages must be paid, by rejecting it and announcing a strike vote. The purpose in taking the strike vote is obvious. The leaders of the brotherhoods evidently think that such a vote will put terror into the hearts of the railway managements and the public. They favor that rather than have the railway service of the country paralyzed; the managements and the public will fall on their prayer bones and tearfully concede them much or all of what they demand.

The leaders of the brotherhoods are quite capable, not only of making the threat of a nation-wide strike, but of carrying it out. The public should not delude itself into believing otherwise. If they get a strike vote. there will be a good chance for a strike. The railways ought not, and probably will not, grant the demands, or any part of them, unless after arbitration; and unless the leaders or the brotherhoods are bluffing, they are extremely indisposed to arbitrate.

In the circumstances, the disposition shown by officials of the national government to let the dispute drift along without interference indicates a want of appreciation on their part as to what may occur which is difficult to understand. A nation-wide strike in the midst of a national political campaign

would be a very bad thing for the party in power; and a nation-wide strike at a time when the country actually has an army in Mexico and is in daily danger of serious trouble with some European power would be a national calamity and the result of moral treason on the part of those who called it.

The railways have gone as far as they can possibly be ever justified in going to avert trouble. There is not only $100,-000,000 a year involved, but, what is more important, a great principle. This is the principle that labor disputes on railways should not be settled by strikes or threats of strikes, but by arbitration by some impartial tribunal competent intelligently to pass on the issues involved. The National Conference Committee of Managers has offered this, and it would be a crime against the rights and welfare of the railways, of the large majority of their employees, and of the American public for it to offer any more, no matter how many strike votes may be taken. The time has come for the railways to make a final stand against the unreasonable demands of labor unionism; and no railway officer, high or low, who is fit for his job, will even suggest, much less actually advocate, the roads offering the train service employees any concession that will cost a penny, unless some impartial body has held that they should give it. If there must be a fight to a finish, this is as good a time as any to have it.

A HIGH CAPACITY CONSOLIDATION

When the first Mallet compound to be used in this country was built for the Baltimore & Ohio by the American Locomotive Company in 1904 it was considered enormous, both in point of size and power. It developed 71,000 lb. tractive effort, working compound; but the Delaware & Hudson's latest Consolidation develops a maximum tractive effort of over 61,000 lb., which would have been considered altogether beyond the limits of possibility at that time. It is worthy of note that J. E. Muhlfeld, sponsor for the first American Mallet, is also the prime mover in the application of pulverized fuel to this large Delaware & Hudson Consolidation. It has a boiler which was built for a higher working pressure than is now being used and with a factor of adhesion at present of 4.35 it is quite evident that there is ample adhesive weight to permit the use of higher boiler pressure. With the maximum working pressure, 220 lb., the Consolidation will develop 65,000 lb. tractive effort.

This locomotive was built for fast freight traffic, as well as slow, and provides the high sustained capacity necessary in fast freight work without going to the length of boiler required in locomotives of the Mikado type. That it compares with locomotives of this type will be seen by a glance at some of the comparative figures for this engine and a large Mikado recently built. Both of the locomotives have 27 in. by 32 in. cylinders, but the Mikado uses 10 lb. less working pressure and has 57 in. drivers, as against 63 in. for the Consolidation. The Mikado develops 64,500 lb. tractive effort, which is practically the same as that of the Consolidation when using the boiler pressure for which it was designed; but considering the characteristics which are vital to high sustained capacity, the total heating surface of the two locomotives is practically the same, while the Consolidation has a larger superheater and an advantage of 61 cu. ft. in firebox volume. With pulverized fuel, a higher and at the same time a more uniform temperature is obtained throughout the firebox than with coal burned in a solid form, so that the use of pulverized coal in this engine places it in the Mikado class from the standpoint of sustained capacity, and without the necessity of the trailing truck necessary to carry the boiler on a Mikado type locomotive. This locomotive is an example of what has been accomplished in the past few years toward increasing the boiler capacity per unit of weight of the boiler, the means employed in this case being a combination of the superheater, brick arch and pulverized fuel. And the end is by no means yet in sight.

PROGRAM FOR THE WEEK

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION

MONDAY, JUNE 19, 1916

9.30 A. M. TO 1.30 P. M.

Prayer	9.30 A. M. to 9.35 A. M.
Address of President	9.35 A. M. to 9.50 A. M.
Intermission	9.50 A. M. to 9.55 A. M.
To allow those who wish to retire to do so, although all are requested to remain.	
Action on minutes of convention of 1915	9.55 A. M. to 10.00 A. M.
Reports of Secretary and Treasurer	10.00 A. M. to 10.15 A. M.
Assessment and announcement of dues; appointment of Committees on Correspondence, Resolutions, Nominations, Obituaries, etc.	10.15 A. M. to 10.25 A. M.
Election of Auditing Committee	10.25 A. M. to 10.30 A. M.
Unfinished Business	10.30 A. M. to 10.35 A. M.
New Business	10.35 A. M. to 10.45 A. M.
Discussion of Reports on:	
Mechanical Stokers	10.45 A. M. to 11.00 A. M.
Revision of Standards	11.00 A. M. to 11.30 A. M.
Dimensions of Flange and Screw Couplings for Injectors	11.30 A. M. to 12.00 M.
Individual Paper:	
Standardization of Screw Threads, by Mr. F. O. Wells	12.00 M. to 12.30 P. M.
Individual Paper on:	
Tests of Four Types of Passenger Car Radiators, by Prof. A. J. Wood.	
Topical Discussion:	
Metallic Packing for Superheater Locomotives, Best Material for	12.30 P. M. to 1.00 P. M.
To be opened by Mr. W. E. Woodhouse, C. M. E., Can. Pac. Ry.	
Discussion of Report on:	
Fuel Economy and Smoke Prevention	1.00 P. M. to 1.30 P. M.

ENTERTAINMENT

9.15 A. M.—Members and guests of the Master Mechanics' and Railway Supply Manufacturers' Associations will assemble on the porch of the Marlborough Hotel and march to the Convention Hall for the opening session. Mr. E. W. Pratt, President, and officers of the Master Mechanics' Association will lead the march.

10.30 A. M.—*Orchestral Concert.* Entrance Hall. Million-Dollar Pier.

3.30 P. M.—*Orchestral Concert.* Impromptu Dancing. Entrance Hall, Million-Dollar Pier.

9.00 P. M.—*Social Evening and Informal Dancing.* Special Features. Ball Room, Million-Dollar Pier. Don Richardson New York Orchestra.

TUESDAY, JUNE 20, 1916

9.30 A. M. TO 1.30 P. M.

Discussion of Reports on:	
Locomotive Headlights	9.30 A. M. to 9.45 A. M.
Design, Construction and Maintenance of Locomotive Boilers	9.45 A. M. to 10.15 A. M.
Superheated Locomotives	10.15 A. M. to 10.30 A. M.
Equalization of Long Locomotives	10.30 A. M. to 11.00 A. M.

Design, Maintenance and Operation of Electric Rolling Stock	11.00 A. M. to 11.15 A. M.
Best Design and Materials for Pistons, Valves, Rings and Bushings	11.15 A. M. to 11.30 A. M.
Co-operation With Other Railway Mechanical Organizations	11.30 A. M. to 12.00 M.
Individual Paper:	
Alloy Steels (?), by Mr. L. R. Pomeroy	12.00 M. to 1.00 P. M.
Topical Discussion:	
Instructions to Young Firemen; Number of Men to Each Instructor; Recommended Status of Instructors	1.00 P. M. to 1.30 P. M.
To be opened by Mr. W. H. Corbett.	
Subjects	1.30 P. M. to 1.30 P. M.

ENTERTAINMENT

10.30 A. M.—*Orchestral Concert.* Entrance Hall. Million-Dollar Pier.

3.30 P. M.—*Orchestral Concert.* Entrance Hall. Million-Dollar Pier.

Card Party for Ladies. Exchange floor, Marlborough-Blenheim.

9.30 P. M.—*Informal Dance.* Grand March. Special features. Ball Room, Million-Dollar Pier. Don Richardson New York Orchestra.

WEDNESDAY, JUNE 21, 1916

9.30 A. M. TO 1.30 P. M.

Discussion of Reports on:	
Powdered Fuel	9.30 A. M. to 10.00 A. M.
Specifications and Tests for Materials	10.00 A. M. to 10.30 A. M.
Modernizing of Existing Locomotives	10.30 A. M. to 11.00 A. M.
Train Resistance and Tonnage Rating	11.00 A. M. to 11.30 A. M.
Subjects	11.30 A. M. to 12.00 M.
Topical Discussion:	
Best Method of Introducing Oil to Cylinders of Superheater Locomotives	12.00 M. to 12.30 P. M.
To be opened by Mr. Jos. Chidley.	
Resolutions, Correspondence, etc.	12.30 P. M. to 12.45 P. M.
Unfinished Business	12.45 P. M. to 1.00 P. M.
Election of Officers, Closing Exercises	1.00 P. M. to 1.30 P. M.

LOST

A Masonic pin was lost in the Hippodrome, Saturday evening; also, Badges 3132 and 3277. Return to Secretary Conway's office.

A cream-colored Spanish lace scarf was lost on the Pier at the Carnival Dance Friday evening. The finder will please return to Mrs. Charles E. Mallory, room 522, Traymore.

FOUND

One kid glove and one cane. Apply to John D. Conway, Secretary R. S. M. A.

An overcoat was left at the O'Malley Beare Valve Co. booth. Owner may obtain by identifying.

A ticket from Atlantic City to New York was picked up on the Pier by a sweeper. It is at the *Railway Age Gazette* office and will be returned to the owner upon identification.

THE DELAWARE & HUDSON ENGINE UNDER STEAM

The Delaware & Hudson pulverized fuel burning locomotive, No. 1200, which is on the exhibition track on Mississippi Avenue, will be held under steam and kept fired from 9 a. m. until 4 p. m., on Tuesday, June 20.

FIRST AID TO THE INJURED

Several persons have availed themselves of the Safety-First equipment in the booths of the Breakless Staybolt Company. Miss Hazel I. Miller, a registered nurse, is in attendance, and will give "first-aid-to-the-injured" to those who apply.

A. A. O. N. M. S.

Nobles, attention! Allah has decreed that should the earthly powers that be name Atlantic City for the 1917 conclave of the A. R. M. M. and M. C. B. associations, there shall be held here a mystic reunion of his sons that will surpass the most sanguine expectations. So, Nobles, keep this in mind; and when you pack your 1917 grip put therein your shrine headgear.

R. S. M. A. ANNUAL MEETING

The annual meeting of the Railway Supply Manufacturers' Association was held Saturday at 12 o'clock in Convention Hall.

For the purpose of getting an expression from the member companies, the question of establishing two classes of memberships, one for members who make exhibits and one for members who do not exhibit, was brought up. After some discussion it was decided to leave the matter of dues, rebates, etc., in the hands of the executive committee.

The report of the tellers showed the following elected as new members of the executive committee: Second District, Chas. W. Beaver, Yale & Towne Manufacturing Company, and Harrison G. Thompson, Edison Storage Battery Company; Third District, William McConway, Jr., McConway & Torley Company; Fourth District, George A. Cooper, Frost Railway Supply Company; Fifth District, George R. Carr, Dearborn Chemical Company.

The secretary reported that the nominees for officers for 1915-1916 were: President, Edmund H. Walker, Standard Coupler Company; Vice-President, LeGrand Parish, American Arch Company. By unanimous vote, these nominations were confirmed.

President Ostby, before turning over the gavel, expressed his thanks and appreciation of co-operation to his executive committee and to the presidents of the Master Car Builders' and American Railway Master Mechanics' Associations for assistance in increasing the number of exhibitors and improving the convention as a whole. He also expressed his appreciation for the Association to W. E. Shackelford, manager of the pier, for having the exhibits into place on time, stating that no serious complaints of any kind had been made because he had constantly been on the alert to find out the needs of the exhibitors and satisfy them. "To him," Mr. Ostby said, "the success of the exhibits is largely due."

The following comparative figures given out by President Ostby are interesting:

	1916	1915
Square feet of exhibit space	76,512	70,412
Total member companies	436	410
Number of exhibits	260	222
Extra badges issued	1,227	1,068

President-elect Walker presented Mr. Ostby with a past-president's badge. In accepting his election Mr. Walker said he hoped the association would continue the practice of making the vice-president the new president for the reason that it gave the president the opportunity of familiarizing himself with all the duties before he came into office and undoubtedly would result in greater satisfaction and economy for the association.

THE M. C. B.'S WIN AT BASEBALL

For the first time in several years the baseball fans attending the conventions were satisfied with what turned out to be a real baseball game, teams representing the M. C. B. and M. M. Conventions being the contestants. Both teams were especially fit and it was a hard fought battle up to the sixth inning, when Dugan lost control of the ball, passing men to bases and giving them easy hits. Due to the lack of proper familiarity amongst the members of the teams this little fluke settled the game, the Master Mechanics' team becoming demoralized. The most sensational play was made by W. D. Arter. With two men cut and a man on third he made a left-handed backhanded catch, saving a score. The day was ideal for a good game and there were exceptionally few errors made when the makeup of the teams is considered. The umpires—Dick Sawyer and "Pop" Edmunds—performed their parts admirably and their decisions were respected. The following is the line up of the teams:

Master Car Builders	Master Mechanics
B. F. Goodman, c. f., B. & O.	F. R. Fitzpatrick, l. f., Penn.
G. R. Kreider, l. f., Penn.	W. D. Arter, s. s., N. Y. C.
Bert Robbins, c., Erie.	W. K. Campbell, 2d b., N. Y. C.
E. Kelsh, s. s., Erie.	W. E. Greenwood, 1st b., M. K. &T.
R. C. Merritt, 3d b., Erie.	G. F. Laughlin, r. f., A. C. L.
S. Rigling, 1st b. (capt.), Penn.	J. W. Miller, c., N. Y. C.
T. Padgett, p., Erie.	E. G. Chenoweth, c. f., C. R. I. & P.
F. J. Mueller, 2d b., B. & O.	J. F. Stapleton, 3d b., N.Y., N.H.&H.
C. L. Schwartz, r. f., St. L. Ry.	J. Dugan, p., N. Y. C.
A. La Mar, Manager, Penn Lines.	M. C. M. Hatch, mgr., D. L. & W.

The Master Mechanics were the first to go to bat. The following is a report of the game by innings:

First Inning

Fitzpatrick breezed. So also did Arter. Campbell hit an easy one to Padgett and was thrown out at first, retiring the side. No runs.

Goodman hit an easy one to Stapleton who fumbled, Goodman safe at first. Goodman stole second. Kreider popped to the pitcher and Goodman was doubled off second. Robbins hit safely between short and third. Kelsh hit safely to right, Robbins taking third. Kelsh stole second. Merritt walked, filling the bases. Two out, two strikes and three men on bases. Arter for the M. M.'s caught a backhanded fly just off second, retiring Rigling and the side. This play brought a roar of appreciation from the stands. No runs.

Second Inning

Greenwood out on strikes. Laughlin struck out. Merritt threw Miller out at first. No runs.

Padgett struck out. Mueller flied to Laughlin who misjudged the ball, Mueller getting two bases. Schwartz to first on dead ball. Goodman up. Each runner advanced on passed ball. Goodman hit to pitcher. Mueller out at the plate. Goodman out trying to steal second. No runs.

Third Inning

Chenoweth struck out. Stapleton called out on strikes. Dugan breezed. No runs.

Kreider bunted to second and was thrown out at first. Robbins grounded to Arter, who threw low to first, making Robbins safe. Robbins out stealing to second. Kelsh grounded to second and was thrown out at first. No runs.

Fourth Inning

Fitzpatrick up. Padgett registered his eighth strike out. Arter at bat. Struck out on a fast breaking out shoot. Campbell at bat. Hit to deep right for three bases. First hit M. M. made. Greenwood grounded to third, bringing Campbell home for the first run of the game. Greenwood safe. Greenwood out trying to steal cn passed ball. One run.

Merritt sent a hot liner to second and reached first safely on error of second baseman. Rigling hit to pitcher who threw Merritt out at second. Padgett hit in front of base and Miller threw him out at first. Rigling went to second on Padgett's out and stole third. Mueller struck out. Dugan showed his nerve with a man on third. No runs.

Fifth Inning

Laughlin up. Out at first on Kelsh's assist. Miller safe on a hit to short. Chenowith up. Miller out trying to steal second on a passed ball. Chenowith struck out. No runs.

Schwartz out on fly to Fitzpatrick. Goodman hit safe tô short right field. Kreider up. Goodman stole second. Kreider breezed. Goodman took third on a passed ball. Robbins safe on fly to short left field. Goodman scored, tieing the game. Kelsh out on a fly to Campbell. One run.

Sixth Inning

Stapleton struck out for second time. Dugan up. Singled to center field. Fitzpatrick popped to pitcher and Dugan was doubled off first, retiring the side. No runs.

Merritt up. Merritt proved a good waiter and went to first on four balls for second time. Merritt went to second on a poor throw from catcher to first in an effort to catch him off base. Rigling walked. Both advanced on passed ball. Padgett hit safe over second, Merritt scoring. Mueller hit safe into right field and in a series of wild throws by Campbell and Miller the bases were cleared. Schwartz hit safely to third making first. Goodman reached first on a series of fumbles. Kreider hit to left field for one out. Robbins out, Campbell to Greenwood. Schwartz stole third, Goodman going to second. Kelsh singled to left field, Schwartz scoring and Goodman to third. Goodman scored on a throw to second. Kelsh safe at second. Merritt hit three-bagger, scoring Kelsh. Rigling singled to center, scoring Merritt. Padgett out on pop fly to first. Eight runs.

Seventh Inning

After the end of the sixth inning the crowd begins to thin out. Arter at bat. Arter hit safe to right field. Campbell singled to right field and sent Arter to third. Greenwood at bat. Merritt threw Greenwood out at first. Laughlin at bat, out at first by grounder to pitcher. Miller skied to Kreider ending the game.

Final score 9 to 1 in favor of the M. C. B.

A great deal of credit is due both teams. It is no easy task for a bunch of even the most experienced players to work together smoothly without more practice together than either team had. The Master Mechanics were particularly handicapped in this respect, they being compelled to use substitutes in several positions.

For the first five innings it was a pitchers' battle royal with little to choose between Padgett and Dugan, the former having the edge through better control.

There never is a closed season on umpires and the crowd did their best to rattle Messrs. Sawyer and Edmonds, cheering vociferously when the former stopped a hot foul with his shins and threatening murder when the latter got balled up on a decision at second on an infield fly. There were many calls for George Wilden and his famous big stick. George, however, confined his efforts to vocal exercises and while absent from the field was not forgotten.

Among the distinguished guests present was Mayor Bacharach. It was by his special effort that the Association was able to play at City Park, the grand stand at the old Inlet park being condemned. Mayor Bacharach issued notices through the Atlantic City papers that the City Park diamond would be closed to the public on Saturday in order to give our boys a chance to play. A special squad of policemen were on hand to keep things running smoothly and his Honor, being a real fan, spent the time on the side lines where he could watch every play.

INFORMAL TEA FOR CONVENTION LADIES

An informal tea will be given on the Pier, from 3 to 5 o'clock, Monday afternoon, for the ladies attending the conventions. The invitation to attend is extended to all the ladies of members of the M. C. B. Association, the M. M. Association and the R. S. M. Association and their guests. The tea will be in charge of a committee of which Mrs. E. W. Pratt is chairman, and is especially intended to enable all the ladies attending the conventions to meet and become acquainted with one another.

STEAM RAILROAD ELECTRIFICATION MOVIES

The Westinghouse Electric & Mfg. Company will show moving pictures of important steam railroad electrifications at the Anita Theatre, on the Boardwalk at Florida Avenue, on Monday and Tuesday afternoons, from 4.30 to 6.30. Admission by badge. Included in the films will be pictures of the Philadelphia-Paoli electrification of the Pennsylvania Railroad; Elkhorn grade electrification of the Norfolk & Western; New York, Westchester & Boston; Hoosac tunnel electrification of the Boston & Maine; New York, New Haven & Hartford; Long Island Railroad; St. Clair tunnel electrification of the Grand Trunk and the New York extension of the Pennsylvania.

THE READING PACIFIC TYPE LOCOMOTIVE

The Philadelphia & Reading is exhibiting this year on its tracks near the boardwalk the first Paciffic type locomotive to be used on this road. The engine has 25 in. by 28 in. cylinders, 80 in. diameter driving wheels and the boiler working pressure is 200 lb., giving a maximum tractive effort of 37,200 lb. The total weight in working order is 273,500 lb., of which 176,900 lb. is on the drivers, 38,000 lb. is on the leading truck, and 58,600 lb. is on the trailing truck. The driving wheelbase is 13 ft. 10 in. and the total engine wheelbase is 35 ft. 7 in. The factor of adhesion is 4.75. The boiler is equipped with a Schmidt superheater and has a total heating surface of 4,151 sq. ft. and 94.5 sq. ft. grate area. The locomotive is equipped with two 9½ in. Westinghouse air pumps and the special equipment includes Walschaert valve gear, Ragonnet reverse gear, Economy spark arrester, Cole trailer truck and Franklin fire door. The tender has a water capacity of 8,000 gallons and is mounted on four-wheel equalized trucks with 6 in. by 11 in. journals.

LITTLE INTERVIEW

Frank McManamy, chief inspector of locomotive boilers of the Interstate Commerce Commission, who arrived Thursday evening, is accompanied by his niece, Miss D. E. Brown, who lives with Mr. and Mrs. McManamy at their home in Washington, D. C. Mrs. McManamy was unable to attend the conventions this year. As noted in Friday's *Daily* (page 1358), the Interstate Commerce Commission has issued an order regarding locomotive headlights, the text of the order being given in the Daily mentioned. Mr. McManamy said yesterday that he did not wish to say anything which might be construed as anticipating the interpretation the Commission will place on its order should any controversies arise concerning its meaning, but that he was willing, for the information of the railway men attending the conventions, to state what he understood to be its significance.

"The order requires," said Mr. McManamy, "that there shall be used on locomotives used in road service headlights which under normal weather conditions will enable persons with normal vision to see a dark object the size of a man for a distance of 1,000 feet ahead of the locomotive. The light may be diminished at stations and in yards to a point which will enable a dark object the size of a man to be seen 300 yards; and this latter is also the power required of headlights used on engines in yard service.

"In my opinion, a 250-watt nitrogen filled incandescent light with an 18 by 9 reflector will meet the requirement for headlights on road engines. I do not know of any oil lamp which will meet it. A properly-maintained oil lamp should be sufficient on switch engines. The rule is not intended to require arc lights. We have not tested enough different kinds of lights to enable me to say anything more regarding the ability of other kinds of lights to meet the requirements.

"In making our tests we had our own men, who were experienced in engine service, ride engines a total of 7000 miles. This was principally on the line of the Chicago & North Western between Chicago and Omaha. This line was used because, so far as we could learn, it is the heaviest traffic double track line having block signals on which electric headlights are used in the United States. Furthermore, its trains run on the left hand track, which is supposed to make it more difficult for the enginemen to read the signals. We tested both arc and incandescent headlights on that road. We found that while using incandescent lights our men had no difficulty in reading the signals correctly.

"The requirements of the order issued by the commission differ from those made by most of the states. Some states require a light which will enable a dark body the size of a man to be seen 1000 feet, or even 800 feet, but the usual requirement is for a light which will have 1500 candlepower without the aid of a reflector. This requirement is much more stringent than that made in the order of the commission, as a 1500 C. P. light in good condition will enable an object to be seen a distance of 1600 to 2500 feet."

AT THE TRAPS

Sixty-three shooters from the three Associations faced the traps on the end of the pier during the first four days of the convention. C. A. Hardy, of the Whiting Foundry Equipment Company, Chicago, was easily high gun, with 304 broken out of 350 fair targets, giving him an average of 87 per cent. Twice he broke 24 out of 25 and his last time up broke 25 straight. With the exception of the last day, there was a hard, cold cross-wind blowing and part of the time a drizzling rain, which undoubtedly kept the scores down. It was the first attempt with moving targets at unknown angles for many of the shooters, but in the majority of cases the second and third times up showed improving scores.

The prize given by the Dupont Trapshooting School for high gun for the week goes to Mr. Hardy. Incidentally Saturday was the biggest day in the history of the School, with 3,150 targets thrown. The scores follow:

	Per Cent
C. A. Hardy, 304 x 350	87
Henry Lee, 339 x 425	80
T. C. deRosset, 39 x 50	78
K. R. Hare, 114 x 150	76
H. A. Hegeman, 19 x 25	76
W. E. McCann, 190 x 250	76
E. E. Whitmore, 19 x 25	76
A. O. Van Dervort, 35 x 50	70
B. H. Grundy, 136 x 200	68
L. B. Valentine, 33 x 50	66
D. C. Anderson, 32 x 50	64
E. M. Barnum, 16 x 25	64
T. O'Malley, 32 x 50	64
L. V. Stevens, 16 x 25	64
H. H. Hibbard, 95 x 150	63
H. M. Hitchcock, 31 x 50	62
C. Hyland, 31 x 50	62
W. G. Ransom, 30 x 50	60
R. T. Scott, 15 x 25	60
C. C. Kendrick, 44 x 75	59
C. M. Baker, 56 x 100	56
F. L. Gormley, Jr., 14 x 25	56
R. E. Kinkead, 28 x 50	56
J. H. Bendixon, 179 x 325	55
W. F. Kall, 27 x 50	54
A. W. Stephenson, 40 x 75	53
J. M. Coffey, 26 x 50	52
T. H. Endicott, 13 x 25	52
R. K. Reading, 62 x 125	49
Edward Wray, 37 x 75	49
A. C. Adams, 36 x 75	48
F. C. Dunham, 15 x 25	48
H. A. Dieffenbach, 36 x 75	48
H. I. Gormley, 12 x 25	48
H. A. Hamilton, 12 x 25	48
B. S. Johnson, 12 x 25	48
G. H. Lewis, 12 x 25	48
L. E. Osborne, 12 x 25	48
C. R. Mills, 68 x 150	45
J. E. Epler, 33 x 75	44
J. A. MacLean, 41 x 100	41
F. L. Gormley, 9 x 25	36
H. A. Nealley, 9 x 25	36
W. R. Parker, 9 x 25	36
F. H. Thompson, 35 x 100	35
T. J. Leahey, 8 x 25	32
R. L. McLellan, 8 x 25	32
J. M. Ryan, 8 x 25	32
J. Brogan, 7 x 25	28
J. M. High, 20 x 75	27
S. D. Page, 23 x 75	27
M. C. Beymer, 11 x 50	22
R. G. Gilbride, 11 x 25	22
A. F. Ashbacker, 5 x 25	20
R. W. Schulze, 5 x 25	20
H. B. Chamberlain, 4 x 25	16
A. C. Pollock, 4 x 25	16
F. S. Wilcoxen, 4 x 25	16
J. H. Beggs, 3 x 25	12
F. G. Kall, 6 x 50	12
B. C. Hooper, 3 x 25	12
A. W. Whitford, 3 x 25	12
W. B. Wheeler, 2 x 25	8

THE GOLF TOURNAMENT

Each successive year the interest in the annual golf tournament of the M. C. B., the M. M. and the R. S. M. Associations grows apace. We may cite the fact that in 1914 there were 92 members of these associations as players in the first tournament; and in 1915 there were 127 players. In the 1916 tournament yesterday there were 163 players. It is believed that the entertainment committees may well afford in the coming years to give heed to the growing pastime of golf and encourage the tournament idea on the days between the conventions.

Yesterday's event was given on the links of the Atlantic City Country Club. The weather conditions, in great contrast to the rains and cold weather of the preceding days, were simply perfect. It was a beautiful June day, and in fact all conditions required by the most fastidious golfer were present.

The Golf Committee's work was excellent, and its chairman, E. H. Bankard, Jr., for his performance of his difficult duty of handicapping and starting the large field, deserves great credit for the successful outcome of the event. When it is considered that 50 players made net scores within 10 strokes of the winning score, the handicapping feat deserves more than passing notice. The Golf Committee has worked hard and consistently over the details of the event since last winter. The committee consisted of E. H. Bankard, Jr., chairman; D. E. Sawyer, L. B. Sherman, B. A. Clements and W. T. Kyle.

The trophies consisted of eight handsome solid silver cups, suitably engraved.

The winners, eight cups.—Low net score: H. C. May, W. W. Griswold, E. S. Rockwell and L. A. Williams; blind score: M. K. Barnum, W. L: Wilt, O. C. Hayward and L. B. Sherman.

H. C. May is superintendent of motive power of the Lehigh Valley. W. W. Griswold is the purchasing agent of the Wheeling & Lake Erie and plays at the Highland Park Club, Cleveland, Ohio. E. S. Rockwell is with Heath & Milligan Manufacturing Company. L. A. Williams is with the Flood & Conklin Company. M. K. Barnum is superintendent of motive power of the Baltimore & Ohio. W. L. Wilt is in the mechanical department of the Pennsylvania Lines West, at Fort Wayne, Ind. Oscar C. Hayward is with the Tousey Varnish Company. L. B. Sherman is with the *Railway Age Gazette.*

Those making net scores of less than 100 were as follows:

	Gross Score	Handicap	Net Score
H. C. May	97	26	71
W. W. Griswold	100	29	71
E. S. Rockwell	86	14	72
L. A. Williams	81	8	73
Fred Gardner	89	16	73
L. B. Sherman	94	20	74
T. C. De Rossette	84	10	74
W. L. Allison	100	26	74
H. A. Matthews	95	20	75
H. E. Chilcoat	83	8	75
W. J. Tollerton	111	36	75
G. M. Crownover	105	30	75
B. W. Mudge, Jr.	96	21	75
A. H. Elliott	93	18	75
A. E. Goodhue	104	28	76
Halsted Little	96	20	76
R. H. Weatherly	99	23	76
B. W. Mudge	98	22	76
J. H. Thomas	85	9	76
Conrad Young	93	16	77
C. D. Young	102	25	77
R. C. Vilas	86	9	77
B. A. Clements	102	25	77
M. K. Barnum	107	30	77
W. M. Wilson	90	12	78
W. W. Rosser	110	32	78
W. K. Krepps	100	22	78
C. P. Ripley	86	8	78
R. H. Gwaltney	85	6	79
F. O. Bunnell	112	33	79
F. O. Donnell	98	19	79
Edmond Muncy	91	12	79
George T. Johnson	100	21	79
C. R. Naylor	98	18	80
G. H. Musgrave	89	9	80
L. H. Skinner	114	34	80
S. V. Hunnings	116	36	80
T. Walley Williams	101	21	80
R. G. Worthington	114	34	80
D. E. Sawyer	80	1	81
W. L. Wilt	102	21	81
F. H. Whitney	117	36	81
J. F. Walker	105	24	81
H. H. Gilbert	98	17	81
Geo. E. Howard	107	26	81
C. A. Beider	111	29	81
L. R. Dewey	104	23	81
L. S. Gordon	90	9	81
J. D. Sawyer	95	14	81
J. D. Purcell	106	25	81
George R. Carr	105	23	82
G. A. Nicol	105	23	82
F. A. Elmquist	106	24	82
C. J. Gorman	118	36	82
William Wampler	100	17	83
F. N. Rowe	104	21	83
F. R. DeArmond	119	36	83
J. G. McGee	103	20	83
Alec Turner	113	30	83
R. B. Burton	106	23	83
O. C. Hayward	116	33	83
G. R. Boyce	117	34	83
L. A. Weary	100	17	83
W. H. Patterson	99	16	83
Ross Harrison	95	12	83
C. A. Hardy	109	86	83
Rives Fleming	92	8	84
S. W. Sargent	90	6	84
C. W. Wright	101	17	84
H. A. Gillis	106	22	84
L. O. Cameron	108	23	85
Horace Baker	101	16	85
F. B. Ernst	112	27	85
J. G. Tawse	109	24	85
J. L. Woodbridge	121	36	85
C. P. Wright	110	84	86
H. F. Jefferson	94	8	86
H. M. Perry	122	36	86
F. R. Fitzpatrick	110	24	86
J. R. Cardwell	101	15	86
S. D. Pettit	105	19	86
C. H. True	104	18	86
F. J. O'Brien	110	23	87
Ralph T. Hatch	105	18	87
John Dixon	123	36	87
J. B. Wright	111	24	87
L. E. Adams	105	18	87
Samuel O. Dunn	113	25	88
E. H. Walker	115	27	88
F. E. Schmitz	103	15	88
Samuel Bennett	106	18	88
Joseph Chidley	110	22	88
W. S. Schlafge	164	75	89
Bertram Berry	104	15	89
Geo. E. Scott	117	28	89
C. F. Brown	113	24	89
F. M. Nicholl	125	36	89
A. M. McNeill	122	32	90
G. A. Post, Jr.	106	16	90
Phillip Arnold	108	18	90
R. S. McIntosh	115	25	90
L. E. Jones	126	36	90
C. J. Olmstead	126	36	90
J. Seeley	116	26	90
C. S. Hawley	110	20	90
D. R. McBain	121	31	90
B. V. H. Johnson	125	34	91
W. B. Wise	122	31	91
A. A. Murphy	126	35	91
G. W. Spear	126	34	92
I. C. Rogers	110	18	92
R. E. Rogers	130	36	94
E. A. Stillman	117	22	95
R. S. Le Barre	116	21	95
E. P. Flory	121	36	95
C. C. Farmer	131	36	95
E. H. Potter	126	31	95
H. S. Hammond	115	19	96
M. B. Brewster	132	36	96
G. Q. Lewis	132	36	96
G. T. Cooke	124	27	97
G. A. Post	133	36	97
R. O. Sinclair	129	32	97
W. G. Kauser	131	34	97
G. E. Ryder	134	36	98
M. T. Kee	134	36	98
A. G. Bancroft	134	36	98
J. H. Bryan	134	36	98
S. G. Down	135	36	99
G. L. Bourne	133	34	99
J. H. Schroeder	136	36	100

"WHAT MAKES THE THING GO?"

This question in various forms is on the lips of all those who see the lithographed illuminated displays at the entrance to National Tube Company booth. There are four of them, each about 50 in. high. Mounted on a base representing several sizes of pipe are an outer and inner drum. The inner one has the legend, "IT PAYS TO BE 'NATIONAL'ly PREPARED—

SPECIFY ONLY 'NATIONAL' PIPE," and the words appear one by one as the drum revolves, being seen through apertures appearing in the outer drum (both the inner and outer drum are colored black to represent pipe). An electric light on the inside causes the legend to show clearly.

An examination, however, shows no motor, no springs, no pendulum; in fact, nothing apparently to cause the drum to revolve. To a Railway Age-Gazette representative, however, a National Tube Company man revealed the secret, and we give it to our readers.

"You see," he said, "the heat of the electric light rising, strikes these small projections or blades, and this heat is sufficient to cause the light pasteboard drum to revolve—the same idea we used when we were boys and held a paper windmill over a hot stove and caused it to revolve."

It is surely a unique contrivance. We understand it is entirely new in this particular application and is causing much interested comment.

WHO WAS THE JOKE ON?

Mine Host Mott, of the Traymore, has a little joke.

General Manager Shackelford, of the Million Dollar Pier, has a little joke.

Secretary Conway, of the Railway Supply Manufacturers' Association, has a little joke.

The *Daily* has a little joke.

The first three of the aforesaid little jokes are stories (all three differing from each other) of one and the same incident. The fourth little joke is ours and inasmuch as we own this paper and are telling this story we will exercise the right which belongs to us and tell our little joke story first. It is simply that Messrs. Mott and Conway have told us the story and said that the joke was on Shackelford; also, that Shackelford has told us the same story and said the joke was on Mott and Conway. Our little joke is that each fellow thinks the joke is not on him, but on the other fellow, and has rushed to us to get the story into print. Certain it is that neither of them has "beat the other fellow to it"—for here is the composite story:

Mine Host Mott invited his friends, Conway and Shackelford, to dine with him at the Traymore on a recent evening. Plates were set for three only. A specially printed menu card greeted the guests. The entire dinner was prepared in the "roller grill" within a few feet of the diners so that they could watch the preparations and cooking of the meats, sauces, vegetables, etc. No cocktails were served when the dinner commenced, but a tempting bottle marked "Pol Roger" of the vintage of 1906 was used to refill the constantly emptied wine glasses. The guests noticed, however, that an ordinary drug store cork was in the neck of the bottle when it was first opened. This was suspicious, but no one remarked, except to himself, in drinking the contents of the "Pol Roger" bottle that the taste was that of ordinary champagne cider. Shackelford descanted on the excellence of the wine that he doubted if there were ten bottles of the delicious beverage to be found in all Atlantic City.

In Shackelford's muffin, steaming hot from the "roller grill," he found a ball of twine, but he never "batted an eyelash" and ate the outside crust only. The others apparently did not notice Shackelford's discovery, for their muffins were all right. Shackelford's asparagus stalks, all five of them, were perfectly raw, but covered with a delicious sauce—which he ate, quietly, but with no remarks, except to apparently become more interested and talkative in the discussion and story-telling.

The *piece de resistance* was the French pancakes, right off the grill griddle. They looked so good! In Shackelford's there were two layers of cheese cloth, but the brown sauce made the "innerds" invisible; so he should worry. He said his was a bit tough and asked for another—and got one not doctored; but not a word was spoken concerning the pancakes except that they were delicious. Shackelford's after dinner coffee was served in a cracked cup and the coffee leaked out into the saucer before he could drink it. No remarks, however.

The two guests thanked their host and departed to their homes. The three men have met several times since, but no talking has been done—except to the *Daily*.

RAILWAY CLUB SECRETARIES' ANNUAL MEETING

Members of the Society of Railway Club Secretaries in attendance at the annual meeting held last Saturday morning at the Blenheim were: A. J. Merrill, Atlanta, Ga., Southern and Southwestern Club, chairman; W. E. Cade, Jr., Boston, New England Club, vice chairman; Harry D. Vought, New York, the New York and Central Clubs, secretary-treasurer; J. B. Anderson, Pittsburgh, Railway Club of Pittsburgh; James Powell, Montreal, Canadian Railway Club. Regrets were received from F. O. Robinson, of the Richmond, Va., Club, whose absence was due to the serious illness of his wife, and B. W. Frauenthal, of the St. Louis Club, whose many official duties kept him at his headquarters.

The secretaries, in their interchange of experience, suggestions and opinion at these meetings, never fail to evolve something beneficial to the organizations which they represent. This year was no exception to the rule, and while whatever action taken is recommendatory, approval of what is offered has never been withheld by the executive committees of the various clubs. The effect has been not only helpful to the interests of the clubs, but also to the individual members.

Assuming that this will continue, the secretaries have this year agreed upon recommendations which they believe will materially increase both the value of the official proceedings and the demand for them. A systematic bulletin, appearing in each club publication, will keep members advised of what each club is doing, with advance information as to what has been arranged for future meetings, especially as to papers to be presented and their authors. After the close of the season a complete Index of all papers and authors will be published in the September Proceedings.

It was also resolved that, as this Society originated the idea which led to the organization of the Society of Technical Associations' Secretaries, which is advancing even more rapidly after its first year than was expected, the club secretaries will take a group membership. This means that each club will be represented in the larger organization.

Mr. Cade reported that the New England Club has named a preparedness committee to report on various phases of the subject, and it will seek the coöperation of other clubs which are to be asked to appoint like committees at their September meetings.

A member of one railroad club had sought to have all the clubs use specific papers simultaneously in a given month. The secretaries were a unit in not accepting the proposition on the ground that it was impracticable and likely to detract from the interest in meetings, now so well sustained.

Hereafter the meetings of the Society will convene at 11 A. M., and be followed by a "family luncheon," to which each club president, or, in his absence, the next ranking executive present, will be invited to be the guest of the Secretaries for a round table conference on railroad club affairs. The object is closer unity and the promotion of activities helpful to the clubs.

All efforts to induce the Western Club to reconsider its decision to withdraw from the Society having been without avail, its resignation was accepted with regret.

In accordance with precedent the officers elected last year were continued for another year, the meeting adjourning subject to the call of the chairman.

OSCAR F. OSTBY, AN APPRECIATION

In presenting the past presidents' badge to Oscar F. Ostby at the meeting of the Railway Supply Manufacturers Association, E. H. Walker, the president-elect said:

"As chairman of the Badge Committee, there is a duty which now devolves upon me; a duty that by the alchemy of opportunity is changed at once for me into a distinct pleasure, As old as civilization is the custom of recognizing personal service to country or contemporaries by the conferring of a degree of honor, and the bestowal of a decoration signifying that such honor has been conferred. This Association has conformed to that custom and in the years of its existance has conferred upon a long line of distinguished men of our craft the Badge of Past-President, which pinned to their breasts indicates that they have served well the Association and such service had been recognized.

"Mr. Ostby, this honor is now to be conferred upon you; this badge is to be pinned to your breast, and while the Association makes me its instrument in the performance of this function, it wants you to know that it is the Association that conveys to you its thanks and appreciation for the service you have so well performed for it. I am glad to be the instrument—not because of any delusion as to my ability to properly clothe in words the message of regard and esteem the Association conveys to you, or to adequately express its appreciation of the success of this exhibition, the credit of which is rightfully your. It is because of my close association with you during the year of your work that I believe I know better, perhaps, than any other, the full sacrifice you have made, the obstacles you have overcome, and the singleness of purpose that has inspired your every moment; that purpose of deserving from the Association at the conclusion of your labors 'Well done thou good and faithful servant'.

"Mr. Ostby, that ambition has been achieved. You have left nothing undone that would bring greater dignity to this Association; that would make this exhibition of 1916 greater, cleaner, or more attractively housed. You have brought to a successful culmination a year of brilliant service to your craft, and we can and do say 'well done'. In recognition of the service performed for it, the Railway Supply Manufacturers' Association decorates you with this Past-President's Badge, which you may wear with honor, well-earned, with pride for successful achievement, and with a satisfaction of public recognition therefor."

ADDITIONAL MASTER MECHANICS' REGISTRATION

Allen, G. S.; P. & R.
Arter, Wilbur D., Sup. App.; N. Y. C.; Haddon Hall.
Babcock, W. G., M. M.; N. Y. C.; Dennis.
Barton, F. F., M. M.; D. L. & W.; Traymore.
Basford, Geo. M., Pres.; Loco. Fd. Water Heater Co.; Blenheim.
Bean, S. L., M. S.; A., T. & S. F.; Chalfonte.
Bell, J. Snowden, Jackson.
Bentley, H. T., S. M. P. & M.; C. & N. W.; Blenheim.
Bingaman, C. A., M. E.; P. & R.; Wiltshire.
Booth, J. K., G. F.; B. & L. E.; Traymore.
Boyden, J. A., M. M.; Erie; Chalfonte.
Brangs, P. H., Traymore.
Butler, W. S., M. M.; C. & O.; Blenheim.
Carney, J. A., S. S.; C. B. & Q.; Shelburne.
Carroll, J. T., A. G. S. M. P.; B. & O.; Blenheim.
Chamberlin, E., Mgr. Equip. Cl. House; N. Y. C.; Blenheim.
Davis, Jno. E., M. M.; H. V.; Chalfonte.
Desmond, D. G., M. M.; M. & K.; Chester Inn.
Diehr, C. P., M. M.; N. Y. C.; Fredonia.
Doty, D. M., M. M.; St. L. S. W.; Strand.
Dougherty, W. Q., M. M.; M. & O.; Blenheim.
Edmonds, Geo. S., S. S.; D. & H.; Chelsea.
Emory, J. B., M. M.; A. T. & F. S.; Strand.
Finegan, L., D. M. M.; B. & O.; Blenheim.
Flavin, J. T., M. M.; I. H. B.; Blenheim.
Flynn, Walter H., S. M. P.; Mich. Cent.; Blenheim.
Fries, A. J., A. S. M. P.; N. Y. C.; Chalfonte.
Gordon, H. D., Blenheim.
Greenwood, H. F., S. S.; N. & W.; Alamac.
Haig, W. H., Mech. Engr., A. T. & S. F.; Traymore.
Hamilton, Wm. H., Div. M. M.; A. T. & S. F.; Alamac.
Hammett, Philip M., S. M. P.; Maine Cent.; Shelburne.
Hankins, F. W., M. M.; Cumb. Valley; Chalfonte.
Harris, H. Y., M. M.; Tampa Nor.; Westminster.
Hatch, M. C. M., S. F. S.; D., L. & W.; Blenheim.
Haynes, J. E., M. M.; Montour; Chalfonte.
Henry, W. C. A., S. M. P.; Penna. Lines; Chelsea.
Hess, Geo. F., S. M.; K. C. S.; Traymore.
Hill, J. F., M. M.; W. & L. E.; Blenheim.
Hodgins, Geo. S.; Pennhurst.
Hogan, C. H., Asst. Supt. M. P.; N. Y. C.; Blenheim.
Hunter, H. S., M. M.; P. & R.; Devonshire.
Jackson, R. E., M. M.; Virginian Ry.; Arlington.
Jackson, O. S., G. S. M. P.; C., T. H. & S. E.; Traymore.
Jaynes, R. T., M. M.; L. & H.; Traymore.
Jones, L. B., G. F.; M. D. & S.; Fredonia.
Kaderly, W. F., Gen. Supt.; Ga. So. & Fla.; Dennis.
Kantman, A. G., A. N. M.; N. O. & N. E.; Chalfonte.
Kearney, Alex., A. S. M. P.; N. & W.; Blenheim.
Keiser, C. B., M. M.; Penna.; Chalfonte.
Kells, Willard, A. G. S. M. P.; A. C. L.; Dennis.
Kells, Willard, S. M. P.; A. C. L.; Dennis.
Kelly, W. T., Mech. Eng.; P. M.; Traymore.
Kendig, R. B., G. M. E.; N. Y. C.; Blenheim.
Kiesel, W. F., Jr., A. M. E.; Penna.; Chelsea.
Kneass, S. L., Wm. Sellers Co., Ltd.; Brighton.
Kothe, C. A., M. M.; Erie; Chalfonte.
Leach, W. B.; Blenheim.
Little, J. C., Mech. Engr.; C. & N. W.; Traymore.
Lovell, Alfred; Traymore.
Macbeth, H. A., S. M. P.; N. Y. C. & St. L.: Traymore.
Machesney, A. G.; Det. Lubricator Co.; Lexington.
McCarra, M. F., M. M.; Ill. So. Ry.; Haddon Hall.
McGoff, J. H., M. S.; A., T. & S. F.; Traymore.
McGuire, J. J., M. M.; B. & O.; Chalfonte.
McIlvaine, C. L., M. M.; N. Y. P. & N.; Brighton.
Machenzie, Jno.; Louvan.
Machonic, E. E., D. M. M.; A., T. & S. F.; Alamac.
Maher, P., Traymore.
Mahoney, W. H.; Galena Sig. Oil Co.; Bayard.
Main, D. T., S. M. P.; C. P. R.; Traymore.
Manning, J. H., S. M. P.; D. & H.; Blenheim.
Maxfield, H. H., S. M. P.; Penna.; Brighton.
May, H. C., S. M. P.; L. V.; Chalfonte.
May, Walter, M. M.; C. C. C. & St. L.; Chalfonte.
Meister, C. L., M. E.,; A. C. L.; Chalfonte.
Mengel, J. C., M. M.; Penna. R. R.; Traymore.
Michael, J. B., M. M.; So. Ry.; Pennhurst.
Millen, Thos., Retired M. M.
Milliken, S. M. P.; P. B. & W.; Brighton.
Milner, B. B., F. M. P.; N. Y. C.; Blenheim.
Minshull, P. H., M. M.; N. Y. O. & W.; Traymore.
Monfee, A. J., M. M.; Birm. So. Ry.; Schlitz
Monroe, M. S., M. M.; E. J. & E.; Lexington.
Montgomery, H., M. M.; Penna.; Wiltshire.
Montgomery, Hugh, S. M. P.; Rutland; Dennis.
Montgomery, Wm. M. M.; C. of N. J.
Muchnic, Chas. M.; Amer. Loco. Co.; Blenheim.
Muhlfeld, J. E., Const. Eng.; Blenheim.
Mullinnix, S. W., S. S.; C. R. I. & P.; Dennis.
Murray, E. A., M. M.; C. & O.; Blenheim.
Murrian, W. S., S. M. P.; So. Ry.; Shelburne.
New, W. E., M. M.; K. C. T; Traymore.
Nuttall, W. H., S. M. P.; M. & N. E.; Alamac.
O'Brien, Wm. J., G. F.; Kanawha & Mich.; Haddon Hall.
Orghidan, Const.; Strand.
Osmer, J. E., S. M. P.; Ann Arbor; Dennis.
Page, C. N., M. M.; L. V.; Arlington.
Painter, J. H., S. S.; A. C. L.; Chalfonte.
Perine, D. M., S. M. P.; Penna.; Traymore.
Perrine, W. M., M. M.; C. of N. J.; Chalfonte.
Pfahler, F. P., M. P. I.; B. & O.; Arlington.
Pilcher, John A., Mech. Eng.; N. & W.; Absecon.
Platt, Jno. G.; Hunt Spiller Mfg. Co.; Dennis.
Pomeroy, L. R., Strand.
Porter, Chas. D., A. E. M. P.; Penna.; Blenheim.
Prendergast, A. P., Supt. Mach.; Tex. & Pac.; Traymore.
Purcell, Jno., Asst. to V. P.; A., T. & S. F.; Chalfonte.
Ramage, J. C., Supt. Tests; So. Ry.; Craig Hall.
Redding, D. J., M. M.; P. & L. E.; Traymore.
Reynolds, O. H., Wm. Jessup & Sons; Dennis.
Riegel, S. S., Mech. Engr.; D., L. & W.; Beechwood.
Rink, Geo. W., Mech. Eng.; Cent. N. J.; Dennis .
Ripley, Chas. T., G. M. I.; A. T. & S. F.; Chalfonte.
Robb, W. D., S. M. P.; Gd. Tr.; Blenheim.
Schmidt, Prof. E. C., Univ. of Ill.; Haddon Hall.
Sedgwick, E. V.; Franklin, Pa.; Alamac.
Sheahan, J. F., S. M. P.; A. B. & A.; Chalfonte.
Shull, G. F., M. M.; C. C. & O.; St. Charles.

Sinclair, Angus, Chalfonte.
Small, J. W., S. M. P.; S. A. L.; Chalfonte.
Sprague, L. C., G. M. P. I.; B. & O.; Seaside.
Sprowl, N. E., S. M. P.; At. C. L.; Chalfonte.
Stackhouse, R. J., Supt. M. S.; P. & R.; Blenheim.
Stranahan, J. H., M. M.; D. & H.; Chelsea.
Strauss, M. H., N. Y. C.; Dennis.
Trumbell, A. G., Mech. Supt.; Erie; Traymore.
Vaughan, H. H.; Blenheim.
Wallis, J. T., Genl. Supt. M. P.; Penna.; Traymore.
Werst, C. W.; Sterling.
Wood, A. J.; Pa. State College; Arlington.
Woodhouse, W. E., C. M. E.; C. P. R.; Traymore.
Wyman, R. L., M. M.; L. & N. E.; Pennhurst.
Young, C. B., Mech. Engr.; C. B. & Q.; Traymore.

ADDITIONAL MASTER CAR BUILDERS' REGISTRATION

Baker, Horace, C. M.; C. N. O. & T. P.; Blenheim.
Bentley, H. T., S. M. P. & M.; C. & N. W.; Blenheim.
Bretz, F. K., G. Mgr.; Morgan & King R. R.; Shelburne.
Carney, J. A., S. S.; C. B. & Q.; Shelburne.
Gaskill, C. S., A. E. M. P.; P. B. & W.; Blenheim.
Gillespie, W., M. C. B.; Cent. Vt.; Alamac.
Graham, H. E., V. P. & G. M.; P. A. & McK. R.; Traymore.
Grove, W. E., I. C. D.; P. & R.
Hess, G. F., Supt. Mach.; K. C. So.; Traymore.
Sinclair, Angus, Ed.; Ry & Loco. Eng.; Chalfonte.
Trumbull, A. G., M. S.; Erie; Traymore.
Wyman, R. L., M. M.; L. & N. E.; Pennhurst.

ADDITIONAL SPECIAL GUESTS

Ahner, Geo. P., Pass. Cond.; P. & R.
Anderson, J. W., M. M.; C. & N. W.
Andrews, O. S., Dfts.; B. & O.; Chelt. Revere.
Belfi, Herbert, Cl.; P. & R.
Besler, George, Cent. N. J.; Dennis.
Besler, S. D., Ass't to V. P.; C. B. & Q.; Dennis.
Besler, W. G., Pres.; Cent. of N. J.; Dennis.
Besler, Wm.; Cent. N. J.; Dennis.
Best, J. I., Ch. Cl. S. M. P.; P. & R.; Traymore.
Blackburn, H. E., Inst. App.; Erie.
Boder, Leo, Cl. to V. P. & G. M.; P. & R.
Boring, H. L., P. W. I.; Penna.; Silverdale.
Borup, O. V., Dftsn.; B. & O.; Chelt. Revere.
Bradley, W. H., M. M.; C. & N. W.
Bretz, F. K., Gen. Mgr.; Morg't'n & Kingw'd; Shelburne.
Brodman, R. W., Long Island; Schlitz.
Brooke, J. C., S. Mach. & Tools; B. & O.; Arlington.
Brown, John P., Pr. Ex. Div. 41 U. S. Pat. Off.; Strand.
Bullock, J. W., Dftsn.; B. & O.; Arlington.
Burns, James, Cl.; P. & R.
Butterworth, J. A., Pur. Dept.; So. Ry.; Haddon Hall.
Calkins, A. E., Asst. to S. R. S.; N. Y. C.; Traymore.
Campbell, W. K., N. Y. C.; Bouvier.
Carson, Ray, Sec. to G. M.; C. L. & T. P.; Blenheim.
Chidley, Joseph, Ass't S. M. P.; N. Y. C.; Traymore.
Clark, J. P., Supr. of Sig.; P. & R.
Cowgill, C. P., Foreman; P. R. R.; Morton.
Corbett, W. H., Dis. M. M.; Mich. Cen.; Pennhurst.
Coyle, G. W., Eng.; B. & O.; Lyric.
Craig, J. M., Sup. Elec. Car Light.; P. R. R.; Shelburne.
Cramer, W. A., Sta. Master; N. Y. C.
Crawford, M. R., Foremn. Stations; Cent. N. J.; Louvan.
Crump, M. J., Ass't P. A.; West. Myld.; Traymore.
Culver, Geo. B.; N. Y. C.; Traymore.
Curd, H. N., Asst. Cash. Len. Car Wks.; So. Ry.; Shelburne.
Dailey, E. B., Ass't Dir. Purch.; S. P. Ry.; Chelsea.
Dambach, C. O., Supt.; W. Pitts. Ter.; Alamac.
Desmund, Jas., R. F. of E.; D. & H.; Chelsea.
Doyle, J. S., Supt. C. Eq.; I. R. T.; Shelburne.
Driscoll, Frank E., Ass't to P. A.; Erie; Chelsea.
Dugan, James E., N. Y. C.; Bouvier.
Duncan, J. H., F. E. H.; At. City R. R.
Eldridge, Geo. P., P. & R.
Emerick, H. F., Ass't G. P. W. I.; B. & O.; Tabor Inn.
Faulkner, E., Mech. Insp.; A. T. & S. F.; Chelsea.
Foreman, John L., M. Carp.; P. & R.; Galen Hall.
Freire, J. J. Da Silva, Director; Central Brazil; Blenheim.
Funnell, Walter, M. S. F.; N. Y., O. & W.; Netherland.
Gearhart, John F., G. F.; P. R. R.; Alamac.
Gee, N. E., Designer E. L.; P. R. R.; Wellsborough.
Geffrey, Thomas, G. P. W. S.; D., L. & W.; Alamac.
Gettys, H. L., M. I.; N. & W.; Princess.
Gossler, Geo. S., F. Erect. Shop; P. & R.; Wellsborough.
Gross, Edward G., M. M.; C. of G.; Sterling.
Hazzard, W. L., Sup. P. W.; N. Y. C.; Traymore.
Heins, Horace; P. & R.
Heiser, Charles E., Dftsn.; At. City R. R.; Chester Inn.
Henry, H. B., Ass't to V. P.; S. P. Ry.; Chelsea.
Herring, W. M., Ch. Cl. G. S. M. P.; So. Ry.; Arlington.
Hess, Franklin E., K. C. S.; Traymore.
Hibbs, C. E., Ass't R. F. E.; Penna.; Frontenac.
Hunt, H. S., Ch. Cl.; D. & H.; Traymore.
Johnson, L. B., Mech. Insp.; A. T. & S. F.; Chelsea.
Jones, L. M., Ass't to G. M.; N. So.; Traymore.
Kachel, Lincoln B., Asst. Tr. Master; P. & R.
Kapinos, G. H., G. F.; B. & O.; Wittle.
Kauffman, G. B., Pass. Agt.; At. City R. R.
Kelsch, Edward; Erie.
Klink, Chas. B.; P. & R.
Knippenbach, J. G.; P. & R.; Chester Inn.
Kreider, G. R., Car. Dept.; P. R. R.
Leed, J. M., Sig. Rep'man; W. J. & Seashore.
Lenox, Weston, Sp. Appren.; P. & R.; Ocean View.
Lively, B. F., Mgr. Lenoir Car Wks.; So. Ry.; Shelburne.
Lyman, C. J., P. W. I.; B. & O.; Tabor Inn.
McClelland, J. W., Sup. Sig.; P. & R.; Shelburne.
McClure, Robt., Cl.; P. & R.
McCracken, John T., M. P.; I. R. T.; Breakers.
McDonough, J., Ass't S. S.; B. & O.; Traymore.
McKelvey, W. D.; Penna.
Maurer, W. R., Mech. Eng.; N. Y., N. H. & H.; Haddon Hall.
Mayhew, J., P. & R.; Pennhurst.
Meier, E. G., Traymore.
Melchoir, P. J., Mech. Insp.; A. T. & S. F.; Chelsea.
Merritt, Ralph C.; Erie.
Miller, John W., N. Y. C.; Bouvier.
Mitchell, C. E., Insp.; B. & O.; Chalfonte.
Morningstar, R. E., Dftsmn.; B. & O.
Morris, Wm., Pur. Dept.; P. R. R.; Dennis.
Mowry, A. T., Asst. E. H. F.; Penna.; Hamilton.
Mowry, Nelson A.; Hamilton.
Mueller, F. J., Stenog. to S. M. P.; B. & O.; Bouvier.
Mullen, Patrick, Engineman; P. & R.; Monticello.
Mullinnix, Morris, Dennis.
Murphy, J. P., Genl. Storekp.; N. Y. C.; Chalfonte.
Musgreave, Wm., Cl.; P. & R.
Padgett, Thomas; Erie.
Perrine, C. H., C. of N. J.; Chalfonte.
Phillips, N. N., Cl.; P. & R.
Pinney, C., Mech. Insp.; A. T. & S. F.; Chelsea.
Ramsey, G. E., Eng.; B. & O.; Lyric.
Rathfen, G. B., Spec. Agent; N. Y. C.; Dennis.
Reardon, F. C., Supt. Stoves; D. & H.; Chelsea.
Rhodes, Robert S., Elec. Dept.; N. Y. C.; Runnymede.
Rider, J. B., P. Y. & McK.; Traymore.
Rigling, S., Car Dept.; P. R. R.
Robbins, Bert; Erie.
Rohow, G. P., L. I.; I. C. C.; Haddon Hall.
Rottenberry, H. T., M. M.; P. & R.; Devonshire.
Rule, Geo., Eng.; B. & O.; Castro.
Sauerburg, C. G., M. Insp.; A. T. & S. F.; Chelsea.
Schaff, C. E., President; M. K. & T.; Traymore.
Schenck, S. T., Ret. Eng.; P. & R.
Schramm, F. J., Ch. Cl., M. P. Dep.; D., L. & W.; Alamac.
Sedden, Edw. F., G. M. F.; L. V.; Dennis.
Seiders, J. L., F. B. S. S.; P. & R.; Albemarle.
Simms, E. C., L. I.; I. C. C.; Haddon Hall.
Skinner, L. H., C. C. to P. A.; So. Ry.; Blenheim.
Smith, Adam F., Storekeeper; P. & R.
Smith, Admiral J. A. B.
Smith, J. J., E. S. F.; B. & O.; Whittle.
Spratt, Thomas, Ass't P. A.; N. & W.; Traymore.
Stevens, J. V., Mech. Insp.; A. T. & S. F.; Chelsea.
Stranahan, J. H., M. M.; D. & H.; Chelsea.
Street, O. B., Div. Acct.; B. & O.; Strand.
Streeter, L. P., A. B. E.; Ill. Cent.; Dennis.
Talevich, E. J., Mech. Insp.; A. T. & S. F.; Chelsea.
Thalheimer, M. C., Dftsmn.; B. & O.; Chelt. Revere.
Vyne, Albert G., Ass't E. H. F.; P. R. R.; Islesworth.
Wallborn, E. W., F. C. I.; P. & R.
Walter, L. J., Erect. For.; C. of N. J.; Jackson.
Waterfield, J. S., Ass't Ch. Cl.; S. A. L.
Werst, Harry K.; Sterling.
Whalen, R. F., Supt.; St. L. & S. F.; Strand.
White, H. M., Eng.; B. & O.; Castro.
Whitsitt, W. B., Dftsmn.; B. & O.; Chelt. Revere.
Wilson, H. S., Insp. of M. P.; So. Ry.; Traymore.
Wood, A. J., Penn. State Coll.; Arlington.
Woodworth, C. B., Gen. F.; B. & O.; Traymore.
Wooten, L. E., Gen. Mgr.; K. S. & E.; Blenheim.
Wright, T. A., V. P.; K. S. & E.; Blenheim.
Zimmerman, G. W., G. F. C. S.; P. & R.; Somerset.

Conventionalities

Malcolm S. Simpson, of the Pressed Steel Car Company, will arrive Sunday morning wearing "the smile that won't come off." It is a boy named Malcolm Hume Simpson, born June 7.

"Tom" Madill, of the Sherwin-Williams Company, is stopping at the Blenheim. When he returns to Chicago, if Mrs. Madill's health will permit, they will take a two months' trip to the Yellowstone.

Oliver Perry Reese, assistant engineer of motive power to D. F. Crawford, on the Pennsylvania Lines West, is especially interested just now in the construction and design of Santa Fe type locomotives.

According to his annual custom, Walter N. Cottingham, president of the Sherwin-Williams Co., will leave shortly, with his family, for his estate, which is just outside of London (England), to spend the summer.

Prominent in the A. R. E. E.

Left to right: H. C. Meloy, engineer electrical appliances, New York Central, Lines West; E. W. Jansen, electrical engineer, Illinois Central, and president Association of Railway Electrical Engineers; E. Wanamaker, electrical engineer, Rock Island, and vice-president Association of Railway Electrical Engineers.

E. A. Woodworth, formerly the popular chief clerk to W. J. Tollerton, general mechanical superintendent of the Rock Island Lines, is at the convention this year with Mrs. Woodworth, for the first time as a supply man. It will be remembered that he has been recently appointed western sales manager of the O'Malley-Beare Valve Company.

R. T. Jaynes, master mechanic of the Lehigh & Hudson River, is greatly delighted at the performance of the new Mikados on his road. He is also particularly interested in the problem of using slide valves on superheater locomotives and has obtained excellent service results from locomotives thus equipped.

A. La Mar, master mechanic, Pennsylvania Lines West, and also manager of the M. C. B. baseball team, has a very charitable disposition. Toward the close of the fateful sixth inning of the game last Saturday, when the M. C. B.'s had cut loose, he rushed up to the "official score keeper" and inquired the score; "for," he said, "I want to tell them when to stop!"

If anybody has any doubts as to the value of superheater switcher locomotives they need only ask C. F. Giles, superintendent machinery of the Louisville & Nashville, or M. F. Cox, assistant superintendent machinery of that road, regarding the service this type of locomotive is giving them in Louisville. They cannot speak too highly of its performance.

This is George A. Barden's sixteenth convention of the M. C. B. and M. M. Associations and Mrs. Barden's sixth. George says he is happy in the thought that now he is sure enough a member of the "Old Guard," as well as a hard worker in the Enrollment Committee. Mr. and Mrs. Barden arrived early from Philadelphia and are, as usual, guests of the Shelburne.

B. P. Flory, superintendent of motive power, New York, Ontario & Western, has under his charge the first locomotives to be equipped with a lateral motion device on the leading axle to provide flexibility in the driving wheelbase. These engines are of the 2-10-2 type and have been giving very satisfactory service, eleven of them having made over 16,000 miles without having their tires turned.

When the New Haven disapproves of any proposed action in the conventions it is provided with adequate means for indicating how it feels on the matter. In the discussion on the Settlement Prices for Reinforced Cars the vote seemed so close that a rising vote was called for, when it was discovered that there wre 210 Ayes to 15 Noes. The extra supply of noise on the "No" side was provided by George Washington Wildin.

It is terrible to be afflicted with corns, and then after carefully training and educating a pair of shoes to behave decently toward said corns, go away from home and forget them. Imagine the agony which E. A. Averill must have suffered while awaiting a response from H. B. Oatley to the following telegram: "Forgot my shoes; think they are in the locker on the ship; send immediately parcel post, insured; rush. Weather is wet and cold."

F. W. Hankins, who was recently promoted from general foreman to master mechanic of the Cumberland Valley, is enthusiastic over the condtion of the power and equipment on his road. This property is affiliated with the Pennsylvania. The road is only 163 miles long and has about 60 locomotives. This makes it possible to develop a most compact and efficient organization, and Mr. Hankins is to be congratulated upon his new job.

H. C. May, superintendent of motive power of the Lehigh Valley, is accompanied this year by Mrs. May and their two little boys, one of whom is H. C., Jr. Mr. May is specially interested at this time in the comparatively heavy additions to the power which are shortly to be made on his road. This is especially true of the 30 freight Pacifics which are intended for "high ball" work on the west end of the road, and 40 Mikados with combustion chambers.

Charley Barrett, who was recently promoted to the position of engineer of motive power on the staff of J. T. Wallis, general superintendent of motive power of the Pennsylvania at Altoona, is said to be shouldering the responsibilities of his new position to splendid advantage. Charley is a bachelor, but his friends are still hopeful that since he is making good so decidedly on the railroad he may also be induced to assume the added responsibilities of married life.

Maxmillian N. Groten, a Russian railway engineer, who is spending some time in New York on business connected with Russian railway matters, is attending the conventions and expresses himself as much pleased with the character of the exhibit. He has been an interested listener at the sessions of the Master Car Builders' convention. Mr. Groten is specially interested in refrigerator car insulation and has conducted some experimental work on these lines in Russia.

We've met cigars of many vintages, from the rolled cabbage leaf to the ubiquitous office pickle, but it was left to Sterling Campbell to give us our latest jolt. Imagine a flat cigar. Looks as if Sterling sat on them all the way from the land of "show-me." He handed us a package of young dirigible cigars flattened out. It seems that the cigarmaker's son tightened up the press and then forgot it. Result—a neat tinfoiled package of six good Havana smokers that look for all the world like a hyphenated submarine.

H. C. Pearce, general purchasing agent of the Seaboard Air Line, and Mrs. Pearce spent a few days at the conventions. A. B. Lacey, chief clerk to D. D. Cain, general storekeeper of the Seaboard, was also an attendant this year. This is Mr. Pearce's first visit to Atlantic City and he expresses himself as greatly pleased with the exhibit. Traffic on the Seaboard is generally good at present, but the freight embargoes cause considerable inconvenience. Mr. and Mrs. Pearce left on Sunday night for Washington.

There are ten representatives of the Master Car and Locomotive Painters' Association attending the conventions this year, among them being H. M. Butts, N. Y. C.; C. A. Cook, P., B. & W.; John Gearhart, Penn.; W. J. Joyce, Bald. Locomotive Wks.; R. J. Kelley, recently of the Long Island and now with the Wolfe Brush Co.; D. A. Little, Penn.; J. T. McCracken, Int. Rap. Trans.; B. E. Miller, D. L. & W.; R. W. Scott, Harlin & Hollingsworth, and John D. Wright, Baltimore & Ohio. They are also perfecting arrangements for their annual convention, which will be held at "The Breakers," in Atlantic City, next September.

Jay Henry, of the Safety Car Heating and Lighting Company, was taking his daily suburban trip into New York recently when he noticed opposite him an unusually ugly baby seated on its mother's lap. The woman evidently became annoyed at Jay's persistent notice of the child. Our friend Jay thereupon endeavored to control his unhappy fascination for looking at the child, and he turned repeatedly to his morning paper for relief, but without avail. Finally the mother, very much irritated, leaned toward Jay and fairly hissed: "Rubber! Rub-ber!" Then it was that a relieved smile came over Jay's countenance and he fervently replied: "Madam, thank God! Do you know I actually thought it was real."

One of the boys in the office of E. W. Smith, assistant master mechanic on the Pennsylvania at Altoona, tells an interesting story of how he prepared his article on efficient engine house organization, which was the winner of the first prize in the *Railway Mechanical Engineer* engine house competition last spring. It seems that Mr. Smith, who is, of course, pretty well posted on engine house practices because of having in charge the big terminal at East Altoona, made the remark when he read the announcement of the competition that he thought he might be able to write an article for it. This he immediately started out to do by dictating the story to his stenographer without further thought. When the sheets were handed back to him they looked so good that he made two or three changes and mailed them to New York.

J. J. Sullivan, superintendent of machinery, Nashville, Chattanooga & St. Louis, is rapidly modernizing the power and equipment on his road. He has authority to equip a large number of road engines with superheaters as they go through the shop. He has also recently received three stoker-fired superheater Mallet locomotives of modern construction in every particular for pusher service over the heavy Cumberland grades between Nashville and Chattanooga. These locomotives have about 100,000 lb. tractive effort and recent trials have shown them to be most satisfactory. Mr. Sullivan has also applied a superheater to one of his balanced compound locomotives for the purpose of determining what this combination will do. The road, as a whole, has been improving its property wonderfully.

It is probable that more railway executive officers have attended the Conventions and inspected the exhibits this year than ever before. Three railway presidents were on the Pier Saturday. These were L. F. Loree, of the Delaware & Hudson, C. E. Schaff, of the Missouri, Kansas & Texas, and W. G. Besler, of the Central Railroad of New Jersey. Mr. Besler, who was accompanied by Mrs. Besler, has been a visitor in Atlantic City during the weeks of the Mechanical Conventions in past years. Henry Baker, general manager of the Queen & Crescent, and G. B. Vilas, general superintendent of the Chicago & North Western, also have been here and have looked over the exhibit. E. J. Pearson, vice-president of the New Haven, motored down from New York Saturday and spent a couple of hours in visiting the exhibit.

C. W. Corning, chief smoke inspector of the Chicago & Northwestern, the man who on account of his unlimited information on powdered fuel locomotive operation was designated as the man who put the "powder" in powdered coal at the recent convention of the International Railway Fuel Association, is attending the Master Mechanics' convention this year for the first time. Mr. Corning has followed the Northwestern pulverized fuel locomotive since the installation was made nine months ago and has perhaps more practical information regarding the use of this fuel than any man at the convention. Mr. Corning has successfully overcome the minor difficulties which necessarily occur in experimental work of this kind, the Northwestern engine being the second locomotive to be equipped with the powdered fuel burning apparatus. Those interested in the subject should seek the acquaintance of Mr. Corning, as he has unlimited information on the subject.

R. E. Smith, general superintendent motive power, Atlantic Coast Lines, has some interesting tales to tell regarding the boiler practice at the Waycross shops of that road. Both electric and acetylene welding are used successfully in boiler repairs, as well as in applying new fireboxes to boilers. On a large number of locomotives the new fireboxes are applied in three pieces without removing the outside wrapper sheet from the barrel of the boiler. The inside wrapper sheet is rolled in one piece, the tube sheet is welded to it and the door sheet is formed and fitted up. The wrapper and flue sheet are then placed in the boiler and the door sheet is welded in place. It is unnecessary to remove the mud ring from the outside wrapper sheet in following this practice. This has decreased the cost of the application of new fireboxes over $125 each. With the narrow fireboxes it is necessary to put the firebox in in five pieces. The work, however, is welded as described above and a material saving is made. Mr. Smith attributes the success of this work to the expert welders at the shops.

C. T. Ripley, mechanical valuation engineer of the Atchison, Topeka & Santa Fe, reports progress in the federal valuation work on that road, particularly in regard to the mechanical department. At the present time the field work on the Coast Lines has been completed, this including the shops, power houses, etc. The valuation of locomotives is to be started in July. At present Mr. Ripley has six field pilots and eight office men devoted exclusively to this work. This number will be enlarged as the work progresses. The Santa Fe has been working on mechanical valuation for the last six months and it is expected that a year and a half more will be necessary to properly cover the entire system. One of the fundamental ideas inaugurated by Mr. Ripley in his work and one which has proven to be of decided advantage is that the cost of installation of machines, pipe lines, boilers, home-made shop tools, etc., is determined as they are made in the field, these costs being agreed upon by the railroad pilot and the accompanying government pilot. This eliminates a lot of argument and delay which necessarily occurs if an attempt is made to estimate these costs in the office.

New Devices

EXHIBITS DESCRIBED DURING THE YEAR

In the *Daily Railway Age Gazette* for June 14, 1916, we published a list of new devices which have been described in the *Railway Age Gazette*, the *Railway Age Gazette, Mechanical Edition*, and its successor, the *Railway Mechanical Engineer*, during the past year and which are now being exhibited on the pier. This list was confined to devices of more particular interest to car department officers. The following is a similar list of devices, the application of which is confined to locomotives or to the maintenance of locomotives, which will be of interest to those attending the convention of the Master Mechanics' Association this week.

Simplate Air Compressor Valve.—This valve is made up of a valve seat, a valve keeper and three flat plate ring valves, concentrically over each of which are placed a number of volute springs. The valves are so adjusted that the outer plate opens with a pressure of but ¼ ounce per square inch, while the intermediate plate requires a pressure of one ounce per square inch and the inner plate a pressure of 2½ ounces per square inch before they will open. At slow speeds only the outer valve will open, but as the speed, and the volume of air to be handled, increases the other valves will be brought into operation. This device was described in the October, 1915, issue of the *Railway Age Gazette, Mechanical Edition*, and is now on exhibit at the booth of the manufacturer, the Chicago Pneumatic Tool Company, Chicago.

Automatic Adjustable Driving Box Wedge.—This device is intended to effect a material saving of labor in the roundhouse and is also claimed to increase the life of the locomotive by eliminating stuck boxes and loose wedges. It consists of an adjusting and a floating wedge. The adjusting wedge is tapered on one side to conform to the taper of the jaw and on the other side to conform to the lesser taper of the floating wedge. The latter fits between the adjusting wedge and the driving box, the thin end being placed at the bottom. The adjusting wedge is attached in the usual manner to a wedge bolt passing down through the binder and a spring bracket secured thereto. A coil spring resting on the bracket keeps the adjusting wedge in position, automatically taking up the slack due to wear. This wedge arrangement was described in the *Railway Age Gazette, Mechanical Edition*, for October, 1915. It is the product of the Franklin Railway Supply Company, New York, and is being exhibited by that company.

Ball Joint Connection for Main Reservoirs.—This ball joint is designed especially for use on the ends of main reservoirs to eliminate the trouble experienced from pipe failures at this point because of vibration. It is designed in two styles, one attached with a screw end and the other with a bolting flange. A brief description appeared in the September, 1915, issue of the *Railway Age Gazette, Mechanical Edition*. It may be seen at the booth of the manufacturers, the Barco Brass & Joint Company, Chicago.

Smokebox Blower Fitting.—This is designed to be attached directly to the side of the smokebox. It is provided with three pipe connections. The inside connection leads to the blower nozzle, the right angle connection, to the blower pipe in the cab and the third connection to the roundhouse blower connection. A check valve in the body of the fitting automatically closes the roundhouse blower connection when the engine blower is in operation and raises when the roundhouse blower is in operation. Descriptions of this device were published in the *Railway Age Gazette* of November 26, 1915, and in the November, 1915, issue of the *Railway Age Gazette, Mechanical Edition*. It is the product of the Barco Brass & Joint Company, Chicago, at whose booth it is being exhibited.

Incandescent Headlight Equipment.—The Equipment referred to includes a 32-volt generator set of 350 watts and 1000 watts capacity and a six-volt generator set having a capacity of 150 watts. These sets are built by the Schroeder Headlight Company, Evansville, Ind., and are all of the same general design. They will operate at any pressure from 75 lb. up. The turbine wheel and the armature are fastened to the same shaft, which rotates on two sets of ball bearings. The speed is controlled by a centrifugal governor which controls the admission of steam by means of a regulating valve. The normal speed of operation is 2400 r.p.m. This equipment was described in the *Railway Age Gazette* of February 18, 1916, and also in the *Railway Mechanical Engineer* of February, 1916. The articles referred to also included descriptions of the Sunbeam headlight for incandescent lamps. This has a 12-in. mirror glass reflector and is provided with an adjustable lamp socket to facilitate the accurate focusing of the light. A special type of focusing stand is also referred to which is designed for use in existing arc lamp headlight cases. The equipment referred to is being exhibited by the manufacturers.

Pyrometer for Measuring Temperature of Steel.—This instrument, known as the I-Rite, is a departure from the thermo-electric type generally used. The instrument is designed to measure the temperature of the piece by a comparison of the intensity of its color with an accurately calibrated scale within the instrument. Since it is the color of the piece which is compared the temperature of the piece is directly obtained, rather than the temperature of the furnace as is the case with the ordinary type of instrument. This instrument is of pocket size and can safely be placed in the hands of an unskilled workman. It was described in the May, 1916, issue of the *Railway Mechanical Engineer* and is being exhibited by the Gibbs Instrument Company, Pittsburgh, Pa.

Sullivan Piston and Valve Stem Packing.—This packing is made up of two bevel rings which are placed between a combined spring case and follower and vibrating cup. One of the rings is beveled on both sides and fits in a recess on the inside of the other. The pressure of the spring against the outside packing ring forces it onto the wedge and at the same time against the vibrating cup. The latter being beveled also forces the ring against the rod. The double bevel on the inner ring tends to keep it centred, thus causing it to wear uniformly. A detailed description of the construction of this packing appeared in the *Railway Age Gazette* of November 26, 1915, and in the November, 1915, issue of the *Railway Age Gazette, Mechanical Edition*. This packing is manufactured by the Jerome-Edwards Metallic Packing Company, Chicago, and is being exhibited by that company.

SAFETY CONSTANT BELT TENSION DEVICE

The Safety Car Heating & Lighting Co. (New York), is exhibiting an interesting model which demonstrates the basic principles of its constant belt tension device as employed in the "Under-frame car" lighting generator. This model is fitted with a miniature axle pulley, generator and spring tension de-

Model Showing Constant Belt Tension Feature of Safety Underframe Suspension

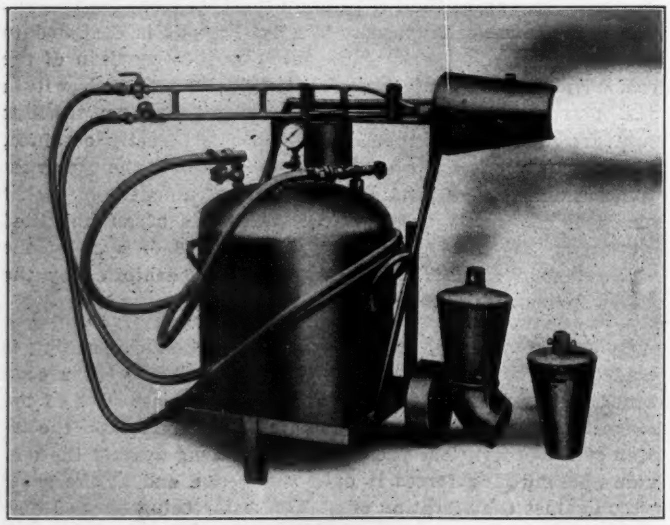
vice, all built to correct scale, weight ratio and spring power. A delicate spring tension balance is inserted in the belt and this indicates at all times the exact tension on the belt. The model is fitted with a takeup device by means of which the distance between car, the axle and the generator support can be changed, as is necessary every time the car rounds a curve.

The movement in the model is such as would correspond to an 8 in. movement in the generator. A 2 in. generator movement is about the maximum swing when the generator rounds the sharpest curves encountered; but the model demonstrates that even through the generator swing may be four times this, the belt tension is maintained at a constant value. This compensates for any reasonable amount of belt stretch in service.

OIL BURNER WITH PREHEATING ARRANGEMENT

A fuel oil burner is being exhibited by the Hauck Manufacturing Company, Brooklyn, N. Y., in which a number of improvements have been incorporated.

The design and construction of the burners and their meth-

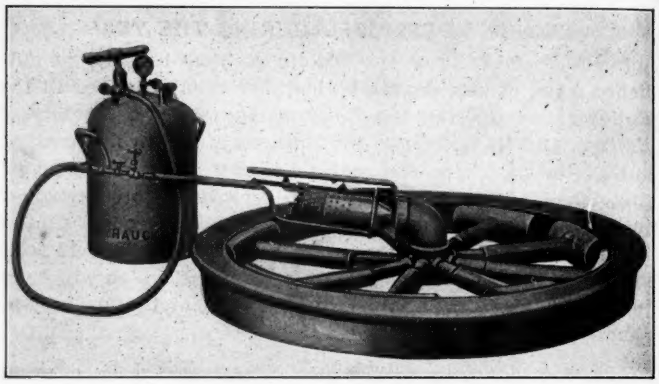


Hauck Burner with Preheater

od of atomization are generally well known. The latest Hauck burner, however, is equipped with a recently patented oil and air preheating arrangement which automatically raises the temperature of the moisture in the compressed air, changing it into steam. A much steadier and hotter flame is thereby obtained. It is also possible with this method of preheating to use heavier grades of oils.

The tank is supplied with a combination funnel and relief valve for filling the oil tank, which is operated by releasing the air pressure in the tank gradually and safely. There is also provided an automatic shut-off valve, which operates in any emergency, shutting off the oil supply from tank if the oil hose should be injured or accidently cut. The several nozzles are interchangeable and are made in sizes which are especially adapted to railroad work.

One of the illustrations shows the Hauck oil tire heater for



Hauck Equipment for Heating Tires

expanding steel tires. The feature of this equipment is the method of distributing the heat from a single burner through a system of radiating conduits. With this type of equipment it is said to be possible to remove 36-in. tires in 3 minutes.

THE CARBIC FLARE LIGHT

A line of acetylene lights for emergency use, such as for wrecking, bridge and signal repairs at night and work in tunnels, is being exhibited by the Carbic Manufacturing Company, Duluth, Minn.

The light is made in five sizes, each consisting of but three parts. It operates on the principle of a diving bell, open at the bottom and closed at the top. In this gas bell a cake holder is inserted which contains a Carbic cake. The opening of the valve leading to the burner reduces the pressure in the bell and permits the water to reach the lower surface of the cake. Gas is immediately formed and flows to the burner. If the gas is generated faster than it is burned, the pressure forces the water in the gas bell down and away from the cake, thus stopping the process of generation, the gas already made being burned before the water can rise and begin to generate gas again.

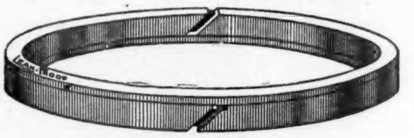
The Carbic cake is composed of carbide of calcium, but in preparation it is coated with a substance which makes a protective cover. This is made of two ingredients, one soluble in water and the other with pronounced protecting qualities. When water touches the bottom of the cake, the soluble substance gives way to the action of the water, permitting its restricted entrance and the forming of a little gas. The slight amount of heat thus generated bursts the protective covering of the Carbic cake and leaves the pure carbide of calcium open to the action of the water. The formation of gas then takes place, subject to the automatic generating feature already referred to. The coating of the particles of carbide is for the purpose of removing any danger of explosion, as the cake covering is non-absorbant and requires a slight or partial submergence, in order that gas will be given off.

A knowledge of the chemical action on which the efficacy of the whole light depends, is not necessary to the operator, or rather, to the men using the light as it does not require an operator in the usual sense of the word.

CLOSED JOINT PISTON RINGS

A type of piston ring, designated as the "Leak-Proof" ring by the manufacturer, has been extensively applied to gas engine cylinders and is now being applied to locomotive cylinders. Rings of this type are being exhibited by the McQuay-Norris Manufacturing Company, St. Louis, Mo.

These rings consist of two L-shaped sections, one placed inside the other in relatively inverted positions. The open-



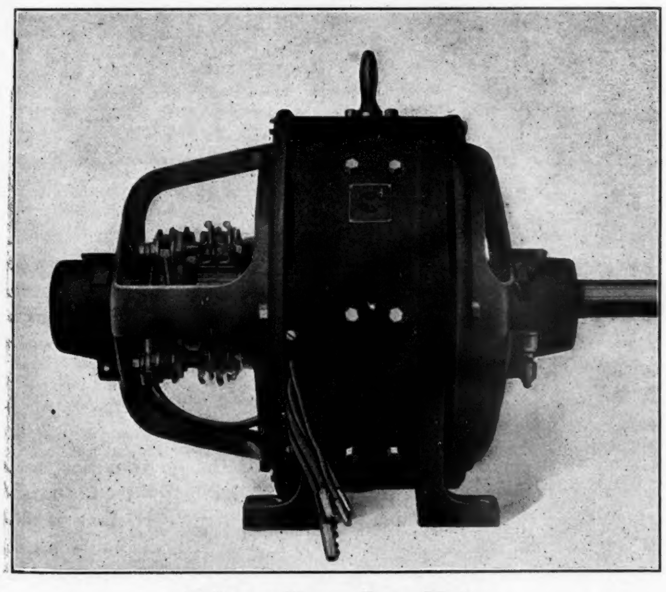
"Leak-Proof" Piston Rings

ings in the two sections are placed at opposite sides of the circle so that each ring entirely seals the opening in the other. Each section is light, but the angle cross section insures ample stiffness to maintain a uniform pressure against the cylinder walls, which, while firm, is lighter and therefore produces less friction than the usual type of solid-section snap rings.

The rings are composed of a special quality of gray iron which is soft enough to take the wear from the cylinder walls. They are accurately finished and carefully tested with gages to insure a perfect fit, both in the cylinder and in the piston grooves.

HEAVY DUTY MOTORS FOR DIRECT CURRENT

A newly developed heavy duty direct current motor is being exhibited by the Reliance Electric and Engineering Company, Cleveland, Ohio, in the design of which a unique plan was followed. All details were submitted to 35 electrical engineers



Reliance Heavv Dutv Motor

in steel mill, railway and industrial service, and in each case the detail was selected which met the approval of the majority. In practically no case are more than 20 per cent of those consulted said to have favored details other than those selected.

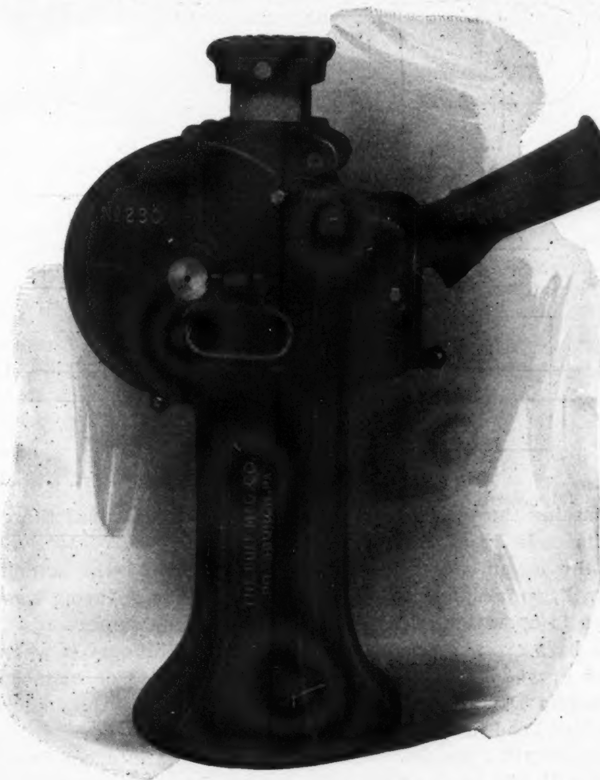
The frame is a steel casting of rugged construction with heavy machined feet cast integral. The journal box housings in the brackets are of the ring oiling type and are provided with pockets into which sediment from the oil may settle. An overflow with an extra large opening is let out from this pocket and is designed to take care of oil as rapidly as it can be poured in at the oil well opening over the oil ring. The oil hole covers are self-closing of their own weight. The leads are brought out through a block asbestos board between the frame and commutator end bracket. This permits the removal of the end bracket by disconnecting the leads at the brush studs, which are readily accessible.

The bearings on both ends of the motor are interchangeable and are liberal in size. The armature shaft is also of unusual size and the armature is built on a spider so that the shaft can be removed without disturbing the windings. The brush holders are mounted on studs carried by a rocker and are removable without taking off the end yoke.

Special attention has been given to the design of parts which eventually will require renewal, in order that they may be replaced with the least possible trouble.

GEARED AUTOMATIC LOWERING JACK

The illustration shows an automatic lowering jack which is being exhibited by the Duff Manufacturing Company, Pittsburgh, Pa. It is fitted with a gear reduction, which is ample to facilitate operation under maximum load conditions. The



Automatic Lowering Jack

pawls engaging the teeth of the first gear operate practically in a vertical position, reducing the side thrust to a minimum.

The case, the pawl and the socket lever are of cast steel. The lever is of a one-piece design and is provided with trunions, which are enclosed in grease-packed bushings with closed ends. The gears are machine-cut steel forgings. All wearing surfaces are hardened, and hardened steel rollers in the rack channel reduce the friction at this point to a minimum.

SAFETY VALVES

The Ashton Valve Company, Boston, Mass., is exhibiting a type of safety valve which has recently been designed throughout in accordance with the recommended practice of the American Railway Master Mechanics' Association. It has a hexagon of standard wrench size and standard pipe-thread connections of the same size as the valve. The lift is 1 in., and the seats are ground to an angle of 45 deg. These are designated as Master Mechanics' valves and are made in both the open and muffled style. The wing valves, springs, spring discs, pressure screws and lock nuts are interchangeable in the several sizes between the open and muffled valves.

GIANT BOLT EXTRACTOR

The illustrations show a bolt extractor designed for removing bolts from locomotive frames, which is being exhibited by John A. Magnusson, Tacoma, Wash. By referring to Fig. 1 it will be seen that the body of the device consists of two side bars *A*, which are joined in the middle by a tie bar

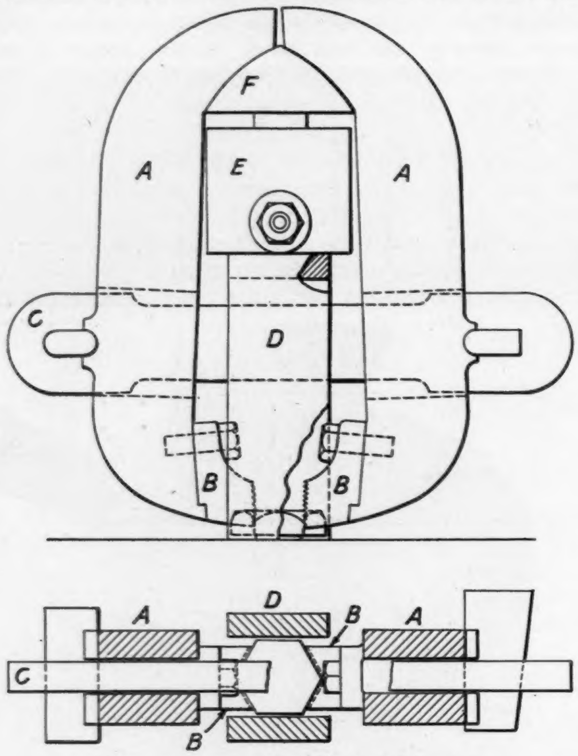


Fig. 1.—The Giant Bolt Extractor

C passing through slots in the side bars and secured thereto at its ends by a straight key and a taper key, respectively. To the lower ends of the side bars are bolted the gripping jaws *B*, so designed as to relieve the bolts of shearing stress when in operation. On the under side of their upper ends the side bars are shaped to form a recess for the curved wedge-head *F*, which forms the upper end of the piston of the jack *E*. A saddle *D* rests on the top of the frame on either side of the bolt head and forms a seat for the jack.

In operating the device the gripping jaws are placed in contact with the head of the bolt and the jack is placed on the saddle. As the jack piston is forced out the action of wedge

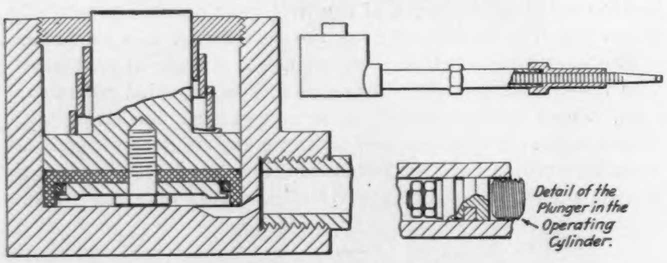


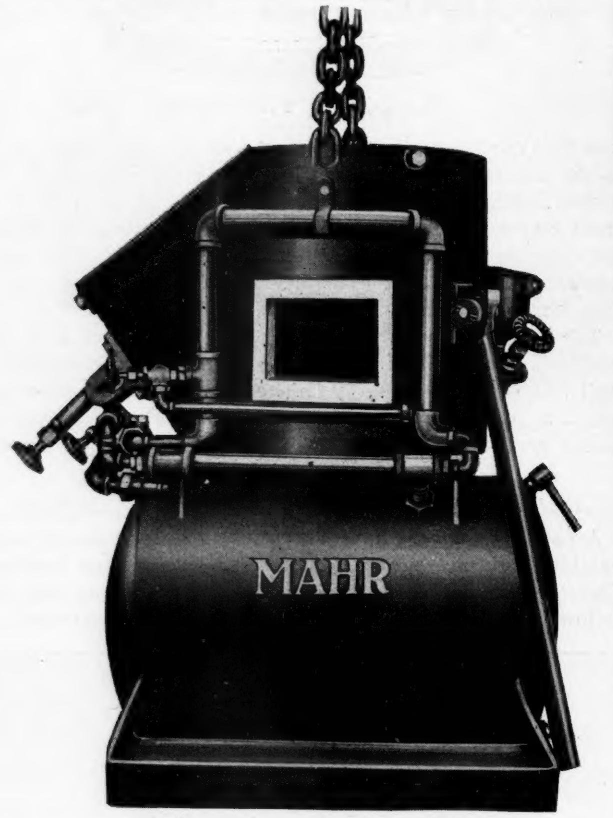
Fig. 2.—Details of the Jack

head securely grips the bolt head in the jaws and as the pressure is increased, starts the bolt.

The details of the jack construction are shown in Fig. 2. The piston is packed with a leather cup which is held against the cylinder walls at all times by an expander ring. The return of the piston when the pressure is released is insured by the volute spring shown in the upper end of the cylinder. In the operating cylinder is a screw which works freely against the plunger in order to reduce the wear on the packing incident to the turning of the plunger in the cylinder. This device has been patented in the United States and Canada.

OIL RIVET FORGE

The compact rivet forge shown in the illustration has been designed by the Mahr Manufacturing Company, Minneapolis, Minn., for special use on track repair work. It can easily be placed on a material car and moved about with the other tools used in the work. The special feature of the forge, in addition to its compactness, is the preheating of the air and oil. The molded lined forges are furnished with a sectional form, which, in relining, is placed in the forge and "Habrec" com-



Compact Oil Rivet Forge

pound packed around it. The form can then be removed, piece by piece, through the forge opening. This lining will give fully as good service as the best fire brick, and to line a forge in the above manner only requires about one hour's time. The tray cast on to the bottom of the oil reservoir serves to hold the cold rivets.

BOILER PRESERVATIVE

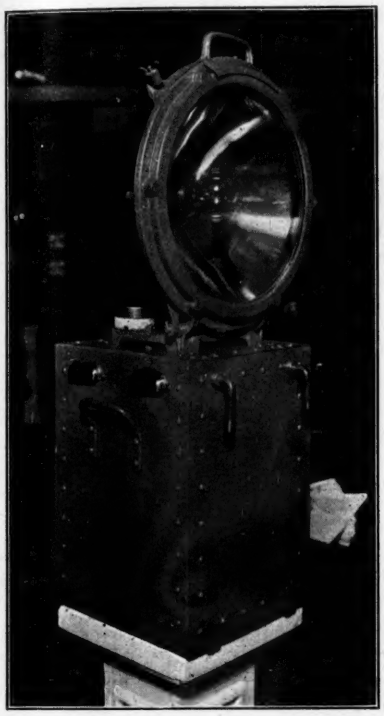
Among the new products being exhibited on the Pier is a boiler preservative, which is called "Boiler Kote" by the manufacturer. It is not a boiler compound in the ordinary sense of the words, as its function is not to alter the chemical constituents of the water in the boiler, but to interpose a shield between the hot plate and the water by the interposition of a film of a viscous fluid somewhat resembling molasses in appearance. The advantage claimed for this material is that while it does no harm to the metal of the sheets and flues, it has the faculty of coating them with a thin film, which prevents even highly impregnated water from reaching the metal of the boiler.

Penetration is another valuable property which is claimed for Boiler Kote. It finds its way between scale already formed, and the slight expansion which then takes place cracks or wedges off the scale. The action is not that of softening the scale or throwing it down as sludge; it simply interposes itself between the plate and the scale, and wedges off the scale already formed.

Boiler Kote is the product of the Flexible Bolt Company, St. Louis, Mo.

PORTABLE STORAGE BATTERY EMERGENCY LIGHTING UNIT

The Edison Storage Battery Company, Orange, N. J., is exhibiting a new portable electric lamp designed for use in emergencies such as wrecks, construction work, freight congestions, etc. It is a self-contained unit, the battery consisting of five cells of the A-4, 150 ampere hour type placed in a steel box on top of which is mounted the lamp in its reflector. The lamp, which is of the 100 watt-gas filled concentrated filament type, and is fitted into a 12 in. parabolic reflector which is said to produce a reflected beam of about a million candle power. The lamp consumes 18 amperes at 6 volts and delivers 140 spherical candle power. The battery has sufficient capacity to keep the lamp burning for over 10 hours.



Portable Storage Battery Emergency Lighting Unit

A thumb screw adjustable feature is provided in the lamp mounting so that the beam of light can be directed at any desired angle. Handles are mounted on each side of the box and a removable cover fitted with wing nut locks permits the quick replacement of a freshly charged battery in case continuous illumination is desired. The weight of the lamp and battery complete is about 150 lb. and the dimensions of the steel box are 14 x 14 in. and 18 in. high.

TURRET TOOLPOST FOR ENGINE LATHES

The variety of operations which must be performed in a railway machine shop, usually with but few repetitions of the same operation at a given time, preclude the possibility of employing the special tools best adapted to each. Machine tools of straightforward design, suitable for general work, must be used on many jobs which could best be done on a turret lathe.

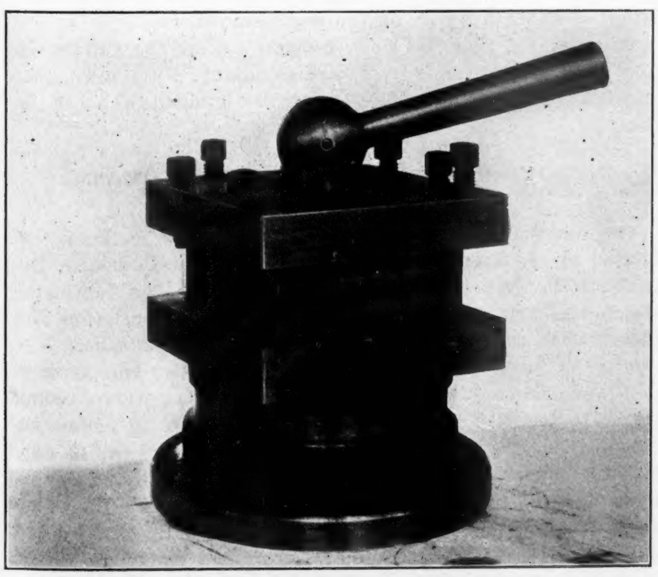


Fig. 1.—Four-Tool Turret Toolpost

In order to make available some of the advantages of the turret lathe on the engine lathe the Phoenix Manufacturing Company, Eau Claire, Wis., has developed a line of turret attachments which may be applied to the carriage in place of the ordinary toolpost. A simple four-tool turret toolpost which is designed to be mounted on the bolt circle of the compound rest is shown in Fig. 1. The tools are placed in the recesses in the sides of the head, where they are held by the set screws shown. The turret head is locked by means of the handle at the top, being released by three-fourths of a turn of the handle.

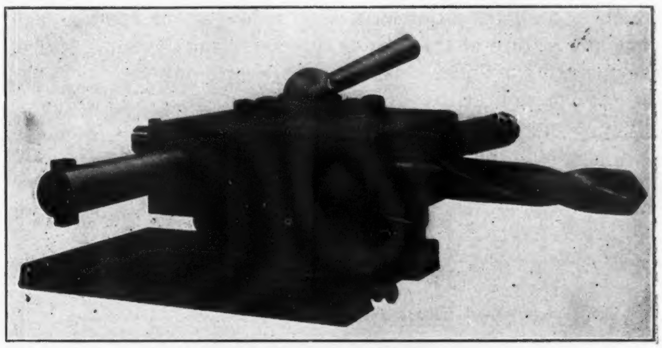
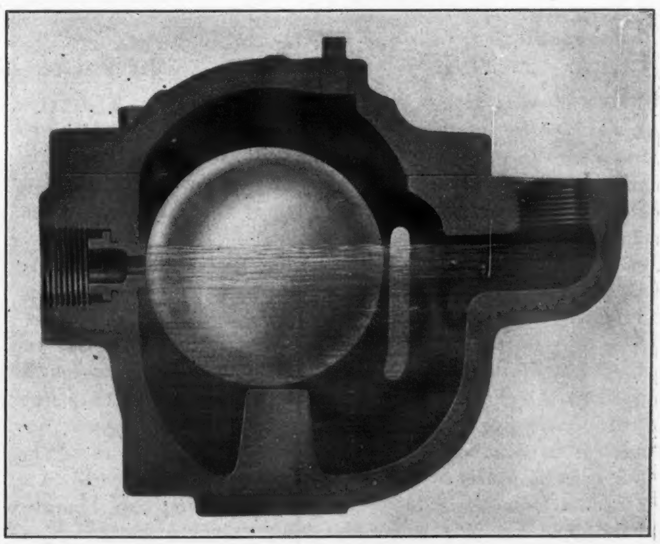


Fig. 2.—Four-Hole Toolpost

A four-hole carriage turret, as shown in Fig. 2, is designed to carry boring bars, drills or reamers which will take from 1¼ in. to 3 in. in diameter. If desired, turning tools may be used in the boring bars, so that outside turning can be done. Several other types of these heads are made and all are furnished to fit the carriage of any lathe.

A SIMPLE STEAM TRAP

A steam trap is illustrated herewith which involves but one moving part. The device is made up of a body, in which is screwed a discharge bushing, and a floating ball which is simply placed in the body and is entirely unattached thereto.



J-M Ball Steam Trap

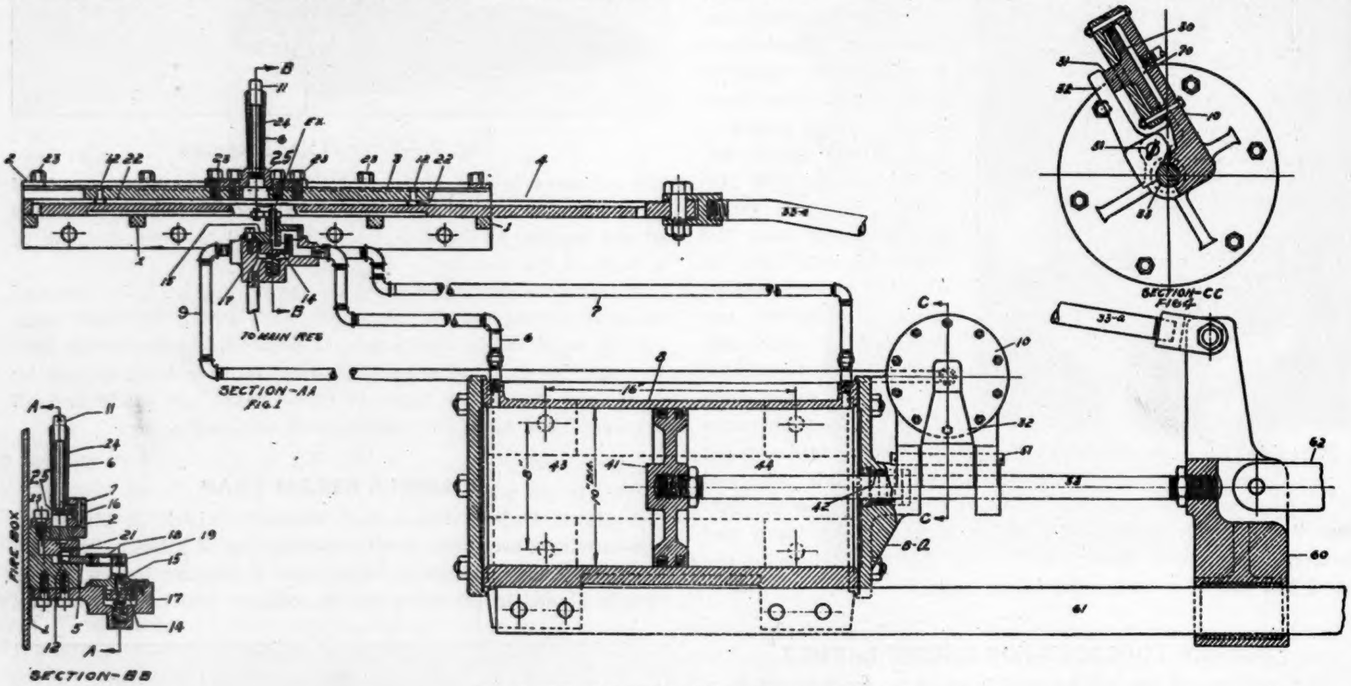
When condensation enters the trap through the inlet, the ball becomes partially submerged. As it is exposed to equal pressure all around except at the outlet opening, it seats against the outlet bushing and prevents the escape of steam. As the height of the water is increased, however, it is floated upwards and the discharge opening is uncovered, allowing the water to escape. Air, being heavier than the steam, col-

lects in a film or layer on the surface of the water and is discharged with the water without the loss of steam. Thus the trap is free from air-binding which causes trouble in some traps. The floating ball principle maintains a constant discharge which adjusts itself to suit the amount of condensation. This steam trap is the product of the H. W. Johns-Manville Company, New York, and is on exhibit at the booth of that company.

SNYDER REVERSE GEAR

The drawing shows a recently developed power reverse gear which is designed to operate with either air or steam. The principle feature of the gear is the mechanical locking device, the operating cylinder being under pressure only while changing the position of the valve motion.

The admission of air to the operating cylinder and the locking diaphragm is controlled by a rotary valve in the cab. This valve seats against the underside of the rotary valve chamber cap, which has three ports; these lead to the two



Snyder Positive Locking Reverse Gear

cylinder pipes and the pipe to the locking device. The valve has cavities in its face communicating with the three pipe ports and the exhaust port through the center of the valve stem. These are so arranged that one end of the cylinder is always open to the exhaust and in lap or neutral position both ends are open to the exhaust. When the valve is in lap position pressure is admitted to the locking diaphragm, being released whenever pressure is admitted to the operating cylinder.

The movement of the rotary valve is controlled by an arrangement of two sliding bars, the upper one of which is moved by the engineer in the cab and the other by the piston in the operating cylinder. The handle on the upper bar houses a latch stem and spring and to the lower end of the latch stem is attached a toothed segment. This meshes in a toothed rack on the guides in which the sliding bars operate. In the upper bar is a longitudinal slot having a double offset. On the upper face of the lower bar are two vertical rollers which work in this slot, being placed so that any movement of the upper bar in either direction will bring the rollers into the offsets and thereby produce a lateral movement of the lower bar, the direction depending on whether the upper bar has been moved forward or back. This movement is transmitted to the rotary valve through a rod and link attached to an arm on the end of the rotary valve stem, the rod being connected with the bar at its inner end by a roller bearing which travels in a straight groove in the lower face of the bar.

From the foregoing it is evident that a forward movement of the upper sliding bar will cause a movement of the rotary valve which releases the locking device and admits air to the rear end of the operating cylinder. As the piston moves forward the lower sliding bar will be carried forward simultaneously. When it has moved a distance equal to that moved by the upper bar, the rollers will again strike the offset and the lower bar moves laterally to its neutral position, thus lapping the rotary valve, locking the gear and releasing the pressure from the operating cylinder. The cutoff obtained will be entirely independent of the condition of the cylinder packing.

The locking device is built into the front cylinder head. It is composed of a diaphragm, the stem of which bears against the upper end of the locking arm. The latter is pivoted near the piston rod of the operating cylinder and when pressure is admitted to the diaphragm chamber the lower end clamps the rod with a force sufficient to require a pull of about 5,000 lb. on the rod to move it.

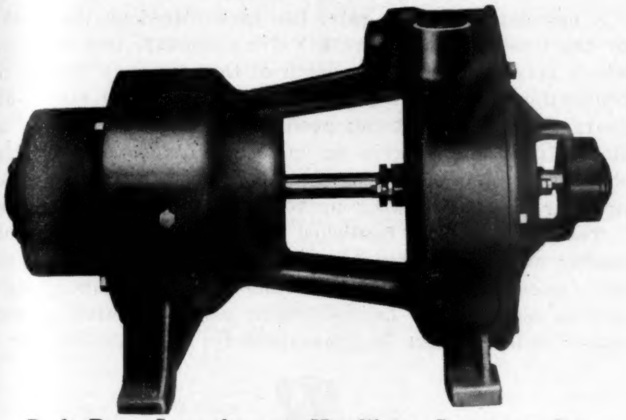
This reverse gear has been brought out by the Pittsburgh Locomotive Power Reverse Gear Company, Pittsburgh, Pa., and may be seen in operation at the company's booth on the pier.

IMPROVEMENT IN THE DETROIT AUTOMATIC FLANGE OILER

The automatic force feed flange oiler which is being exhibited at the booth of the Detroit Lubricator Company, Detroit, Mich., has several improvements over the lubricator which was exhibited last year. A complete description and illustrations of this device appeared in the *Daily Railway Age Gazette* of June 11, 1915, page 1283. The filler cap as originally constructed was sometimes difficult to remove, owing to the fact that it was circular in form and could not be securely gripped by the engineman. The top of the cap as now made is square and offers a freer grip. The priming device by means of which the oil pipes may be filled when the lubricator is first placed in operation was originally constructed without a permanent handle, thus making its operation at times inconvenient. A permanent valve handle has been placed on the end of the priming rod in the new lubricator, thus making it instantly available for operation at all times.

BUDA INCANDESCENT HEADLIGHT

An incandescent electric headlight equipment is being exhibited by the Buda Company, Chicago, which is known as Model G. W., and has been developed since the conventions of last year. In general, this equipment is similar to the



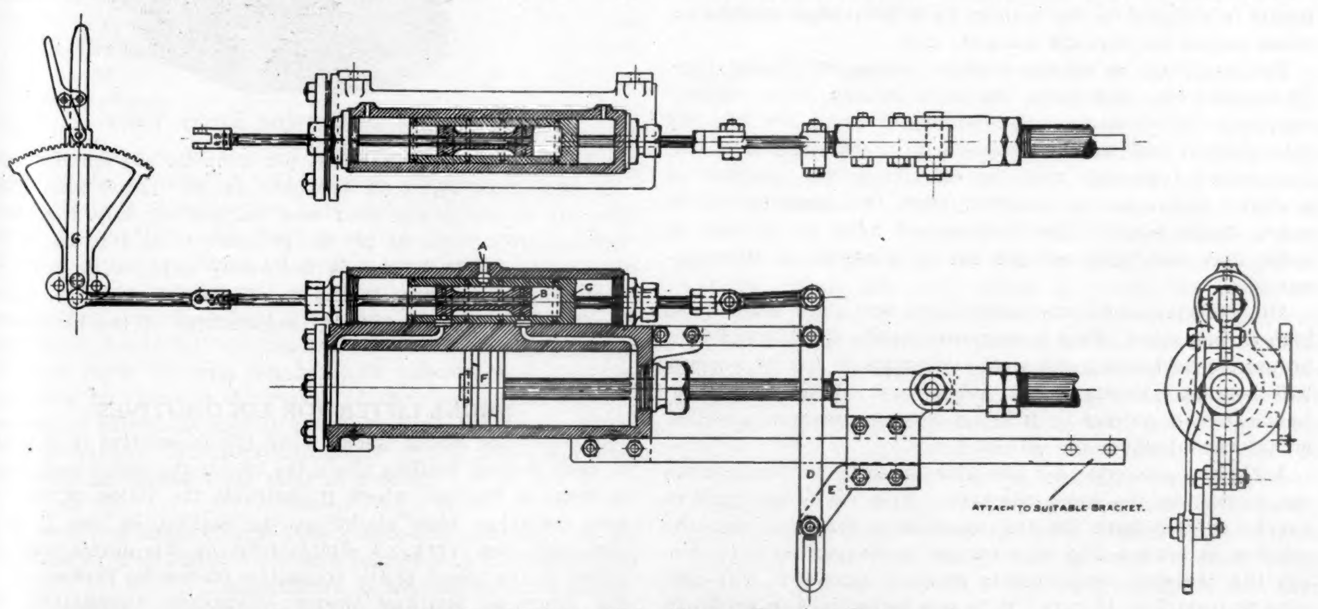
Buda-Ross Incandescent Headlight Generator Set

Buda-Ross arc headlight equipment which has been on the market for some time. The generator has a normal capacity of about 350 watts, but is designed to generate up to 500

BROWN POWER REVERSE GEAR

The Brown power reverse gear has been placed on the market by the Southern Locomotive Valve Gear Company, Knoxville, Tenn., and is being exhibited at its booth.

The construction and operation of the gear will be understood from an inspection of the sectional view of the cylinder and valve chamber shown herewith. Steam is admitted direct from the boiler at the top center of the valve chamber, *A*, the distribution being controlled by the inside piston valve, *B*. This valve operates in the automatic sleeve valve, *C*, which in turn operates in the valve chamber itself. The



Sectional Views of the Brown Reverse Gear

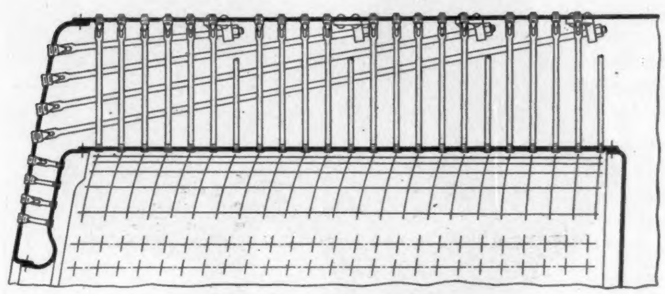
movement of the piston valve is controlled by the reverse lever; when the latter is moved forward it moves the piston valve backward, admitting live steam through the port in the sleeve valve to the rear end of the cylinder. The automatic sleeve valve is controlled by the piston *F* through the combination lever *D*. As soon as the piston begins its forward movement the sleeve valve moves backward until its ports are again lapped by the piston valve. The movement of the piston *F* is thus directly proportional to the movement of the piston valve *B*.

The sleeve valve automatically maintains the operating piston in the position in the cylinder for which the reverse lever is set. Any slight movement of the piston due to cylinder leakage immediately causes the sleeve valve to move from the lap position, when steam is admitted to the weak side of the piston, until the balance is again restored.

The gear has been built with as few parts as possible and is said not to be difficult to maintain. The entire device weighs approximately 390 lb.

FLEXIBLE BOILER BRACE

A system of boiler bracing has been developed by the Breakless Staybolt Company, Pittsburgh, Pa., which involves the same type of construction to secure flexibility that is used in the "Preak-less" staybolt, manufactured by the same com-



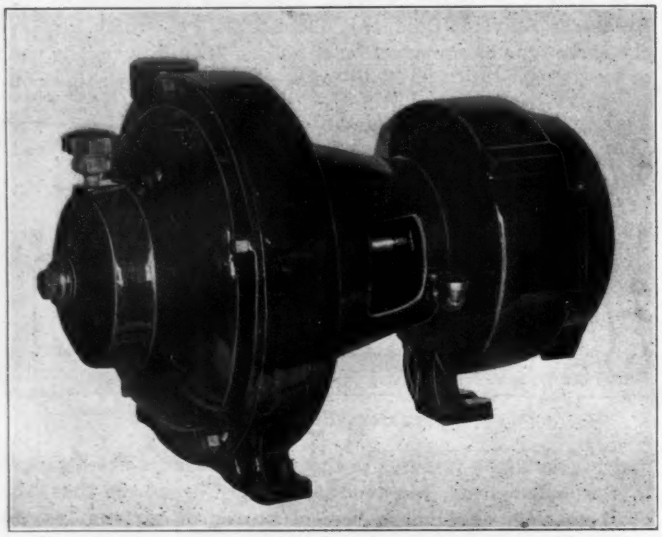
Breakless Boiler Brace

pany. One of its features is the way the braces are attached to the boiler head. Instead of using T-irons on the back head, to each of which a row of braces of varying lengths are attached, the head of each brace is applied directly to the back head in the same manner that the heads of the staybolts are applied. The use of T-irons is thus eliminated. A special form of crowfoot for the attachment of the braces to the roof sheet is shown in the drawing. This is attached to the shell with three rivets, the brace passing through the lug and being secured by means of a nut on the end. Where it is desired, however, these crow-feet may be replaced by angle sections attached to the roof sheet and extending over the curve of the boiler at each plane of brace attachment. The angles may then be drilled for the ends of the braces wherever the latter may be most conveniently attached. This arrangement is especially convenient in the case of Jacobs-Shupert fireboxes. A boiler brace of this type is being exhibited by the manufacturer.

HEADLIGHT GENERATORS

A 150-watt, 6-volt, direct-current turbo-generator set is illustrated, which has been developed by the Pyle-National Company, Chicago. It is designed to meet the requirements of the incandescent headlight, both for switching and road service, and differs in several respects from the older types of generator sets manufacturd by this company for the arc headlight.

The turbo-generator is small and compact and operates with equal success with either superheated or saturated steam. The turbial is of the constant flow, constant pressure type and no governor valve is used. The speed regulation is controlled by a simple fly-weight centrifugal governor, which forces the turbine rotor out of register with the nozzle. Steam is supplied to the turbine by a ⅝-in. pipe and the exhaust passes out through a 1½-in. pipe.



Pyle-National 150-Watt, 6-Volt Headlight Set

The generator is of the bi-polar compound wound type. The field frame and poles are made in one piece, entirely enclosing the field windings, which, in turn, are liberally proportioned and well ventilated. The armature is of the ring wound type and, with the commutator, is mounted on a sleeve which can be removed from the shaft by taking out a single screw. The brushes are fixed in position in order that they will not get out of position on the commutator.

All revolving parts are mounted on one shaft made from high carbon steel. This is supported at the turbine end by a bronze sleeve bearing and at the commutator end by a heavy ball bearing, placed at the turbine end of the generator. Lubrication is automatic, it being only necessary to see that oil is maintained in the oil chambers.

A 2½-kw. generator set has also recently been placed on the market by the same company. This set is designed to supply current both for the locomotive headlight and the coaches in branch line or suburban passenger service. Under the ordinary requirements of such service it will take care of from 7 to 10 cars. It is now being used in suburban service on the Staten Island lines of the Baltimore & Ohio, and one train has recently been equipped by the Chicago & North Western. This set is known as the Type T equipment. It has a governor of the regulating valve type, the valve being controlled by a tension spring fly-weight centrifugal governor mounted on the shaft and attached to the turbine rotor. Steam is supplied by a ¾-in. pipe and a 2-in. pipe takes care of the exhaust. The generator is bi-polar and is wound for 32, 60, 110 or 220 volts.

This set is entirely self-contained and requires no special foundation. Its overall length is 33 in., the height is 19 in. and the width 18 in. It weighs less than 400 lb. Both of the above generator sets are being exhibited by the manufacturers at Atlantic City.

LOCOMOTIVE SAFETY VALVE

A new type of safety valve has been placed on the market by the Crosby Steam Gage & Valve Company, Boston, Mass., which may be seen at the booth of this company during the conventions. It is designed to give a maximum steam discharge without sacrificing positive control of the valve action. It is said to give an unusually large valve opening without any hammering or chattering effect, and the amount of wear without leaking or re-seating has been increased.

These valves are furnished in either the open or the muffled style, for either 3-in. or 3½-in. pipe connections and are designed to be interchangeable with any type of valve now in service. For locomotives at 200 lb. working pressure either style of valve is guaranteed by the manufacturer to discharge more than 13,000 lb. per hour for the smaller size, and more than 16,000 ib. per hour for the larger size. The greatest discharge per hour now claimed for any 4-in. locomotive safety valve at 200 lb. pressure is said to be 12,600 lb. per hour. The valve is ordinarily adjusted to give no warning, but if desired it may be adjusted to give 2 lb. warning. The warning is entirely independent of the blow-down regulation.

Crosby Large Opening Safety Valve

SMOKE LIFTER FOR LOCOMOTIVES

A device for lifting smoke when the locomotive in drifting to keep it from trailing along the top of the boiler and down in front of the cab, where it obstructs the vision of the engine crew has been placed on the market by the Q & C Company, New York. A simple form of this device was decribed in the report of the committee on Smoke Prevention of the American Railway Master Mechanics' Association two years ago. It then consisted of a ring of pipe placed around the top of the smoke stack, perforations in the pipe permitting the discharge upward of a number of jets of steam which raise and also clarify the smoke discharge from the stack at low velocity when the cylinders are not working steam.

As exhibited the pipe has been replaced by a cored passage in the top of the stack from which jets are discharged through holes placed at the proper angle in the casting. With this device it is claimed that the smoke may be raised from 10 ft. to 15 ft. above the top of the stack, which is high enough to maintain an unobstructed view ahead from the cab windows.

Railway Age Gazette

DAILY EDITION

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WE GUARANTEE that of this issue 12,715 copies were printed; that of these 12,715 copies, 11,244 were mailed to regular paid subscribers to the Railway Age Gazette and the Railway Mechanical Engineer; 171 were mailed to advertisers, 300 were provided for counter and news companies' sales, new subscriptions, bound volumes, copies lost in the mail and office use; and 1,000 copies for distribution at Atlantic City.
THE RAILWAY AGE GAZETTE is a member of the Audit Bureau of Circulations.

The Young Men at Conventions

The young men attending the conventions would do well to act on President Pratt's suggestion regarding taking part in the proceedings. The Association must depend on the young men of the present for their officers of the future, and the sooner the younger men get into the way of rising to their feet and taking part in a discussion, the better it will be both for themselves and for the Association. The more a matter is discussed the more likely is there to be a fund of information brought out from all quarters, and there is no one who cannot benefit from learning the ideas of members who come from roads, even if those ideas differ from his own. While the president's suggestion that the officer in charge of the mechanical department should tell his men plainly that he wants them not only to learn all they can by their attendance at the conventions but also to contribute of their experience for the benefit of others, is a good one, it is hoped that such action will be avoided by the prompt action of the men themselves without any urging from their superiors.

The Training Of Men

We have for many years been consistent advocates of the training of young men for future positions in the mechanical department. It has been our constant endeavor to promote the use of apprenticeship systems on all railways and it is therefore with great gratification that we call special attention to that part of President Pratt's address which deals with the problem of providing men for the future. As he says, it is not sufficient merely to train men; there should be a comprehensive system of promotion in connection with the scheme of training so that the officers can keep track of those under them and be thoroughly familiar with their capabilities so that they may act wisely in selecting men for promotion. It we are to have capable mechanics and thoroughly trained officers in the future it is essential that at least as much attention be given to the matter of apprenticeship as is given to the provision of standards pertaining to material and design. If a railway expects to have such standards either maintained or intelligently revised in the future its officers should see to it that those who are to be their successors are given a training which will provide them with the requisite experience to carry out such work.

Co-operate With the Committees

It is a difficult task for some of the committees to obtain exactly the information which they desire and need to comprehensively prepare a report which will give the association all of the information which is available on a subject. It is desirable that committees do as much original investigation as is possible, but it is also necessary that they call on the various railways for the results of their experience along any particular line, and unless the railways respond cordially it places a considerable handicap on the committee's work. We can understand a railroad not wishing to give out information that would be used in an improper manner, but it is well-known that when a committee of either the Master Car Builders' or Master Mechanics' Association asks for information it is with the intention of using that information, for the benefit of all the members of the association, and every road should be glad of the opportunity to co-operate in this way. Furthermore, as referred to in the case of the Committee on Specifications and Tests for Materials, members of the association should show their confidence in the work that has been done by making use of the various standards and recommendations. It is no encouragement to a committee to have the results of its work merely printed in the proceedings, and at the same time to realize that these results are to a large extent a dead letter because of the failure of a great majority of the members to use them.

Adequate Machine Tool Equipment

The President made a timely reference in his address to the futility of continuing in service inadequate and obsolete machine tool equipment. It is beyond comprehension why railway managements will insist on retaining in shops and engine houses machine tools totally incapable of sufficient speed and capacity to perform efficient work in making repairs to modern locomotives. There are many roads on which the locomotive equipment has completely outgrown the repair facilities, with the result that locomotives have to be held out of service for repairs for unreasonable lengths of time in both engine houses and repair shops. But even when these conditions are known to exist, the management continues to order more large power without spending anything like a proportionate amount on shop tools. Machine tool design and construction have advanced rapidly in the past ten years and with the present day operating conditions demanding every possible ton-mile from every locomotive, it is mighty poor economy to leave repair shop and terminal facilities in the same condition that they were ten or twenty years ago.

Designing Locomotives to Suit Conditions

The reference in the president's address to the need of the adoption of more rational methods in determining on new designs of locomotives deals with a matter to which we have frequently referred. It is too true that there is often less careful consideration given to the suitability of a locomotive for its work than is given in the case of a freight car. There is too much haphazard buying of locomotives in this country.

Very considerable economy can be realized by designing locomotives to suit the conditions under which they are to operate. After a careful study of their conditions one of the larger roads in the United States has been following this practice consistently for some time and the results obtained are of such magnitude as regards increased trainload and economy of operation that they are clearly reflected in the road's earnings. There is in fact too little actual designing being done on our railways and too great a willingness being shown to accepting a design which happens to be popular at the time. It has long been a fact that there are "fashions" in locomotives in this country and when these fashions change there is a general rush to adopt new ones whenever new power is purchased without thorough consideration as to its suitability for the particular work required of it. This is a condition which is not creditable and which should be changed.

The President's Address

President Pratt is to be congratulated on the character of his address. He not only gives an interesting summary of recent accomplishments in locomotive engineering, but he brings out some of the greatest essentials of a capably managed motive power department and recommends them not merely for the attention but the action of the Association. The attitude of mechanical department officers toward shop and other costs; the reference to the use of the Association's standards and specifications; the suggestion for new investigations of front end arrangements and the reference to the need of doing something to provide trained men for the future are a few of the most important items in an address, every bit of which should be given the deepest and most careful consideration by every member of the Association. The President's recommendations are of a nature which reflect credit upon himself and upon the Association, and it is to be sincerely hoped that the membership in general, and the incoming officers and Executive Committee in particular, will take prompt steps toward some action which will result in tangible accomplishment along the lines indicated by Mr. Pratt.

Is It Not Time To Wake Up?

Eight years ago the Master Mechanics' Association adopted as recommended practice certain basic principles underlying an adequate apprenticeship system. How many roads are following these principles to-day? Mighty few! Why? Have they been tried extensively and found wanting? No, very few roads have tried them out to a logical conclusion and in the case of one large system at least, where they have been given a thorough trial, they have proved their value beyond a shadow of doubt. How many roads in this country to-day are supplying all of their skilled mechanics in the mechanical department from graduate apprentices which have been given a thorough training in their various trades. One large system is doing this, but we venture to say that there are very few others who come anywhere near this record. It seems strange that while almost every mechanical department officer in this country is complaining because of the difficulty in securing skilled workmen and the lack of efficiency resulting therefrom, such a comparatively few of them are taking effective steps to overcome the handicap by adopting and following out the fundamental principles advocated by the association, thus assuring a plentiful supply of skilled workers. This is all the more to be wondered at when the means of doing it are so comparatively simple and inexpensive and the results are so tremendously big. Possibly it is because the higher officers have not been awakened to the importance of the question. If so, then the Master Mechanics' Association and the mechanical department officers at large should get busy and demonstrate their fitness for holding responsible positions by making the higher officers realize it, thus helping in the solution of one of the biggest and most troublesome problems confronting the mechanical or any other railroad department to-day. As the situation now stands, these basic principles of apprenticeship, which are recommended practice of the association, are more or less of a joke because so few people seem to take them seriously.

Locomotive Front End Design

President Pratt referred in his address to the desirability of further experiments on locomotive front ends with a view to changes in the present Master Mechanics' Association standards. Something of this kind should be undertaken. There have been great changes in the locomotive since the Master Mechanics' standards were formulated, and a great many of the locomotives now being built depart quite radically from them. There does not seem to be any general knowledge of the exact relationship needed between the exhaust pipe and allied parts and the present day boiler. The capacity of the boiler is directly dependent upon the efficiency of the front end arrangement, and it seems logical that there should be a very direct relation between boiler capacity and front end capacity; that is, capacity from the standpoint of removing the gases The results obtained by the Pennsylvania Railroad in front end tests are probably more valuable than those from all other sources. They have demonstrated beyond a doubt that much of the data concerning locomotive front ends is incorrect. The Association should take steps to revise its standards so that they will be in thorough accord with present day boiler requirements.

Comparisons of Switch Engine Performance

In determining the fuel consumption of switching locomotives it is quite easy to fall into error if it is based on engine-miles. This may not be immediately apparent; the figures may seem quite satisfactory and there may be no apparent error in the method of arriving at them, but in comparing the switching service on two different roads, for example, it is found that in one case the fuel cost per engine-mile is 11.92 cents while in the other it is 12.66 cents. This may seem right until we consider the fact that the latter figure is for locomotives using superheated steam, while the former locomotives use saturated steam. The basis for arriving at the engine-miles is the same in both cases. In further considering these figures it is found that the first road mentioned operates switching locomotives which are considerably smaller than those of the second road and with the power being produced in a greater number of units it would seem about reasonable that the road with the smaller locomotives would have the greater fuel cost. This suggests that a method of comparison which will include the tractive effort will be a more reasonable one than the engine-mile, and it is found that the average tractive effort for the locomotives of the first mentioned road is 23,143 lb., while in the second case it is 30,693 lb. On this basis the cost of coal per thousand tractive-effort-miles is, for the road with the smaller locomotives .515 cents, and for the other road .412 cents, showing a substantial saving in favor of the superheater locomotives, as would be expected.

Improving The American Locomotive

It has been in the past a difficult task to impress on American railway men the desirability of adding any complications to the locomotive unless they were assured of a marked advantage from their application; but within the last few years the majority of mechanical men have begun to realize that the ever-narrowing margin between revenues and expenses demands the employment of every possible means of increasing locomotive capacity. The old attitude was generally one of fear of

trouble which might result, and the increase in repair expense involved through the application of any device which added to the locomotive's complication. Such considerations were frequently allowed to overshadow any possible economies which might result, as a great many of the old time men were skeptical as to there being any real economies. It is probable that the inauguration and general success of the superheater in American practice has probably done as much as anything to dispel these ideas, although the task of convincing American railway men of the value and practicability of superheat was by no means an easy one. The general attitude, however, is now almost entirely changed. Railway men have learned to recognize the value of such capacity and economy-producing features as the superheater, the mechanical stoker, the brick arch and compounding as applied in the Mallet locomotive. During the past two years, pulverized fuel has developed into an important factor in future locomotive progress. The new attitude of faith in future developments, rather than one of skepticism, is helping materially to further the continued efforts to make the American locomotive a still better machine from the standpoint of capacity, economy and in fact, all-round efficiency. The feed-water heater has been known for years to hold out the promise of considerable increases in fuel economy, but present indications point to the probability of results from feed-water heating which were beyond the most extravagant hopes of a few years ago. Whether or not compounding will be revived to any great extent, as regards locomotives other than the Mallet type, remains to be seen, but the achievements of the past few years and the consideration of developments now in progress make it extremely unsafe to attempt to predict a limit to American locomotive development.

THE MECHANICAL STOKER

IF ANY evidence were needed to demonstrate the success of the mechanical stoker, as applied to locomotives, the committee report presented on Monday and the discussion which followed it supplies such evidence in abundance. The mechanical stoker has amply demonstrated its ability to keep working boiler pressure on the largest locomotives under the most exacting conditions, and the field for its future development would seem to lie mainly along the lines of improved efficiency and economy. There are now in service locomotives in large numbers which would never have been built had it not been possible to fire them by mechanical means. Their productive capacity is far beyond the limits of steam generation obtainable with hand firing.

It is beyond question that there are many other locomotives now in service whose maximum capacity is beyond these limits, and still these locomotives are not equipped with mechanical stokers. While the operating results being obtained from such locomotives may be good, they are not as good as they ought to be, and locomotives which require a total hourly coal consumption of over 5,000 lb. should not be built unless it is intended to use mechanical means of firing them. The history of the development of the mechanical stoker is one of continually increasing trainload, and it may be stated without fear of contradiction that the mechanical stoker has completely removed the limitation placed on boiler capacity by the placing of coal in the firebox by hand.

It is of interest to note in the discussion that, in spite of some opinions to the contrary, the brick arch can be, and is being, used with entire success in connection with the stoker. The brick arch has in itself done wonders to improve the boiler efficiency and capacity of the American locomotive. The limits of its applicability are by no means reached, and there is no good reason why the valuable features which are inherent to its use should not be obtained on a stoker-fired locomotive as well as one which is hand-fired.

TODAY'S PROGRAM

Discussion of reports on:

Fuel Economy and Smoke Prevention.*	
Locomotive Headlights	9.30 A. M. to 9.45 A. M.
Design, Construction and Maintenance of Locomotive Boilers	9.45 A. M. to 10.15 A. M.
Superheater Locomotives	10.15 A. M. to 10.30 A. M.
Equalization of Long Locomotives	10.30 A. M. to 11.00 A. M.
Design, Maintenance and Operation of Electric Rolling Stock.	11.00 A. M. to 11.15 A. M.
Best Design and Materials for Pistons, Valves, Rings and Bushings	11.15 A. M. to 11.30 A. M.
Co-operation With Other Railway Mechanical Organizations	11.30 A. M. to 12.00 M.
Individual paper—Alloy Steels. By Mr. L. R. Pomeroy.......	12.00 M. to 1.00 P. M.

* Paper was read yesterday, but will be discussed the first thing today.

ENTERTAINMENT

10.30 A. M.—*Orchestral Concert.* Entrance Hall. Million-Dollar Pier.

3.30 P. M.—*Orchestral Concert.* Entrance Hall. Million-Dollar Pier.

Card Party for Ladies. Exchange floor, Marlborough-Blenheim.

9.30 P. M.—*Informal Dance.*—Grand March. Special Features. Ball Room, Million-Dollar Pier. Don Richardson New York Orchestra.

ROTARY CLUB DINNER

The Atlantic City Rotary Club will have a luncheon at the Hotel Schlitz today at 12.30. All visiting Rotarians are welcome.

CARD PARTY FOR LADIES

The entertainment features for today include a card party for the ladies. The entertainment will be held on the exchange floor of the Marlborough-Blenheim at 3.30 o'clock this afternoon and will be in charge of Mrs. Pratt, assisted by Mrs. Flory, Mrs. Kellogg, Mrs. MacBain, Mrs. Hibbard, Mrs. Ross, Mrs. Deverell and Miss Hogan.

NOTICE TO EXHIBITORS

The exhibit committee of the Railway Supply Manufacturers' Association has issued the following notice:

"Do not pack or dismantle your exhibit until the close of the Master Mechanics' meeting, Wednesday. Due notice will be given by the committee.

"Packing boxes, crates and other packing material will be returned without delay.

"The Exhibit Committee thanks all exhibitors for their uniform compliance with the rules and spirit of the Convention."

INFORMAL DANCE TONIGHT

The Master Mechanics' Entertainment Committee refuses to divulge what the words "special features" mean in the official announcement for the dance tonight. Certain it is that plans have been made in connection with the event which are not to be made known until tonight. The *Daily* is pretty close to the Entertainment Committee, and when even the *Daily* is not told the secret a sure enough secret is must be. At any rate a most attractive entertainment is promised when, at 9.30 p. m., the grand march commences in the ball room of the Million Dollar pier. Mr. Clements will be in charge, assisted by Messrs. Denyvan, Hungerford, Bancroft, Coffin, Sawyer, Schumaker, Bentley, Roe and McGinness.

BREAKING ALL RECORDS

The 1911 conventions have been noted as the largest in the history of the M. M. and M. C. B. Associations. No longer will they bear this distinction. The total registration up to Sunday evening was 3,315 this year, as compared to 3,271 in 1911. It is almost 1,000 greater than last year, as shown in the accompanying table. All records are broken for attendance of members of the two associations, special guests and railroad ladies. There are fewer supply ladies than in 1911 and fewer supply men than in either 1911 or 1913.

	1911	1912	1913	1914	1915	1916
Members, M. M. and M. C. B.	612	303	489	539	486	628
Special Guests	331	365	373	360	299	511
Railroad Ladies	401	256	345	269	264	417
Supply Ladies	355	208	282	254	208	306
Supply Men	1572	1408	1516	1349	1116	1453
Total	3271	2540	3005	2771	2373	3315

TRANSPORTATION HOME

The following announcement was read by Secretary Taylor in Convention Hall yesterday: "Kindly notify the railroad members of the Master Car Builders' and the Master Mechanics' Association desiring transportation home over the lines of the Pennsylvania Railroad Company, or the Pennsylvania lines west of Pittsburgh, that such transportation will be provided if they will submit their requests through you. In accordance with the requirements of the law this transportation must be limited to bona fide railroad officials only and cannot include representatives of boat lines, car lines or switching roads operated by industries." (Signed by J. T. Wallis, general superintendent motive power, and D. F. Crawford, general superintendent motive power.)

A SUCCESSFUL TEA FOR THE CONVENTION LADIES

The informal tea for the ladies attending the conventions, which was given on the Pier yesterday afternoon, was a great success. The tea was in charge of a committee of which Mrs. E. W. Pratt, wife of the president of the Master Mechanics' Association, was chairman. The crowd attending almost filled the ballroom, and the ladies were afforded a good opportunity to become more generally acquainted with each other, of which they took full advantage. A good many men dropped in, and the pleasure of the occasion was increased by informal dancing. The tea was from 3.30 to 5 o'clock.

Those who poured were as follows:

Mrs. D. R. MacBain	Mrs. G. W. Wildin
Mrs. R. D. Smith	Mrs. T. W. Moran
Mrs. Alex. Turner	Mrs. Wm. Schlafge
Mrs. Margaret Currie Scott	Mrs. Le Grand Parish
Mrs. D. J. Gilliland	Mrs. Robert B. Barton
Mrs. R. W. Bell	Mrs. R. J. Himmelright
Mrs. Samuel O. Dunn	Mrs. Scott H. Blewett
Mrs. H. P. Bayley	Mrs. W. A. Bennett

Those assisting the committee were as follows:

Mrs. A. L. Whipple	Mrs. Lewis Jones
Mrs. T. M. Ramsdell	Mrs. F. O. Bunnell
Mrs. J. C. Currie	Mrs. J. H. Manning
Mrs. W. C. Arp	Mrs. John D. Hurley
Mrs. W. L. Kellogg	Mrs. William Miller
Mrs. B. P. Flory	Mrs. B. W. Mudge
Miss A. Gertrude Hogan	Mrs. G. W. Spear
Mrs. W. E. Sharp	Mrs. W. B. Leach
Mrs. E. Chamberlain	Mrs. J. Robinson
Mrs. A. Lamar	

COMMITTEE ON OBITUARIES

The following members were appointed to act on the Committee of Obituaries: For G. A. Hancock, W. H. V. Rosing; for L. R. Johnson, H. H. Vaughan; for E. T. Sumner, Henry Bartlett; for W. H. Dunlap, C. F. Giles; for H. S. Hayword, J. T. Wallis; for M. E. Wells, C. B. Young; for J. F. Walsh, J. N. Gould; for J. M. DeVoy, A. E. Manchester; for W. L. Gilmore, D. R. MacBain; for James Maglenn, J. N. Small; for H. N. Sprague, Angus Sinclair.

Secretary Taylor also announced that he had just received notice of the death of Charles F. Roberts, assistant to the locomotive superintendent on one of the roads in Cuba, who died March 1, 1915.

WILLIAM ST. JOHN HONORED

William St. John, of the Safety Car Heating and Lighting Company, celebrated his 76th birthday last evening at a dinner given in his honor at the Hotel Traymore by his friends.

Mrs. John P. Dickson sent the following tribute:

ODE TO 76. (Sounds Like Homeopathy.)

Where is his equal? The Saint so divine!
In summer and winter, he's full of sunshine.
Lightly the years have touched his tall frame,
Lending an air of attraction to same.
In duty or pleasure—he goes in to win—
"All in the day's work," he says with a grin.
Master of every known art in the book,

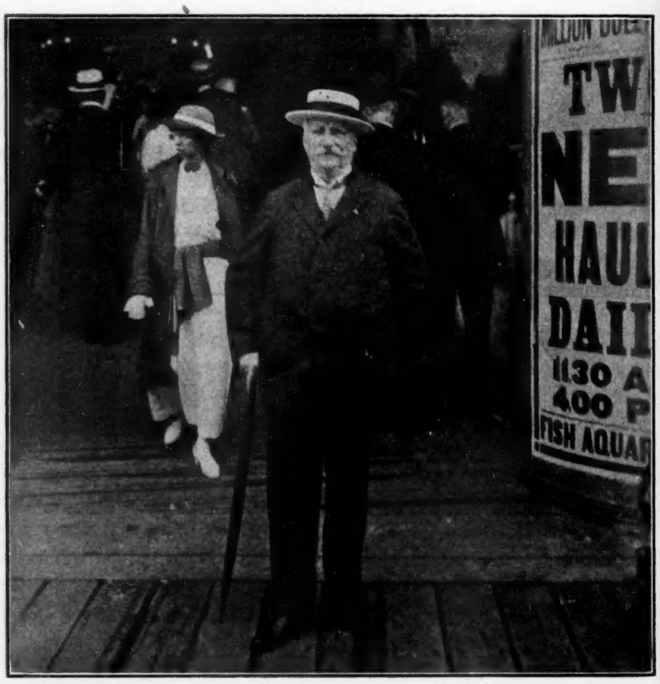
Serenely he conquers where others but look.
Time has no terror for Billy St. John—

Jovial and merry, he just trudges on.
Oh, for an adequate pen to record,
Half of the pleasure and interest he's scored!
Now I must leave you, or else you'll be bored.

P. S.—I felt that I owed this ode to you.

L. P. D.

Mr. St. John, familiarly known as "Saint" to his many friends, has been attending the conventions since 1880 when

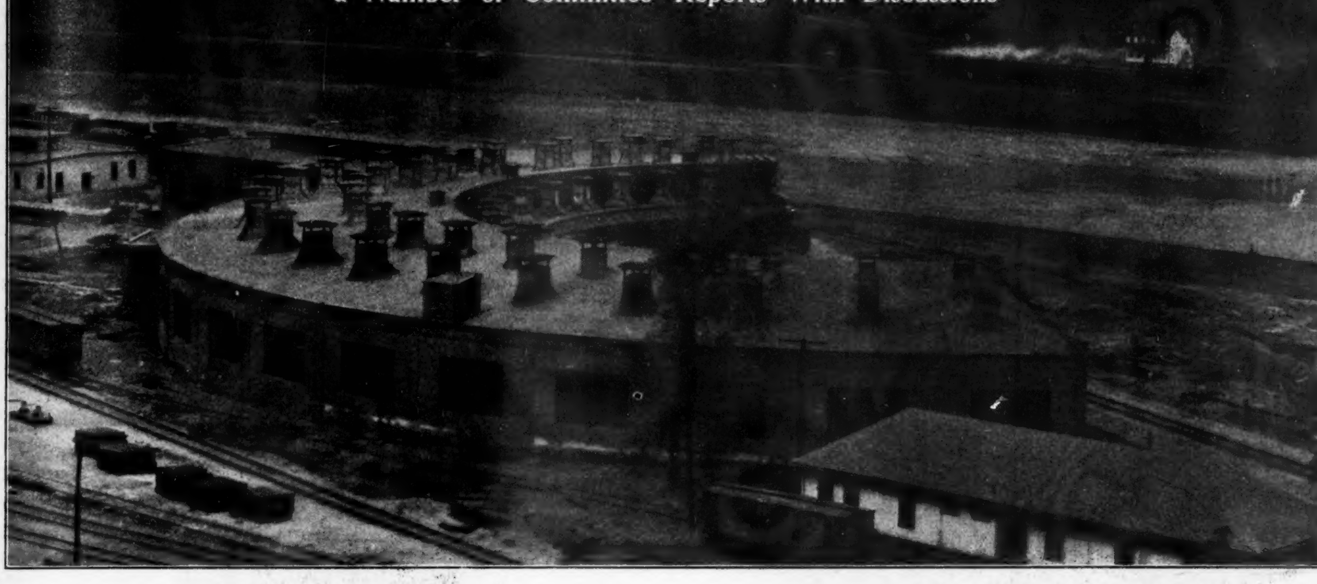


William St. John

the convention was held at the Thousand Islands. Since that time he has been absent from only four conventions. The Master Mechanics held an adjourned meeting in the autumn of 1884 at Niagara Falls; and Mr. St. John took the convention delegates from Buffalo to Niagara Falls during the evenings on an Erie day coach which was the first railroad car equipped with Pintsch-light in this country. Mr. St. John began his long career in the railway supply field with the Pintsch Lighting Company in 1881. The Safety Car Heating and Lighting Co. was organized in 1887 absorbing the former company. Mr. St. John has been with the Safety Co. ever since.

Master Mechanics' Association Proceedings

Monday's Session, Including President's Address and a Number of Committee Reports With Discussions



Dickerson Run Engine House, Pittsburgh & Lake Erie

THE first session of the forty-ninth annual convention of the American Railway Master Mechanics' Association was called to order Monday morning, June, 19, 1916, by President E. W. Pratt, of the Chicago & North Western, at 9:40 o'clock. The Reverend Dr. Thos. J. Cross, of the Chelsea Baptist Church, delivered the divine invocation, and the association was welcomed to the city by Mayor Bacharach.

PRESIDENT'S ADDRESS

It is customary in this address to briefly outline the advance of the art during the past year and to point out certain indications where fields for further research may, perchance, prove fertile and well worthy of further attention.

The annals of this association indicate that to the steam locomotive has been given your chief effort, your main study, and rightfully so, as, even now, with the remarkable installations of electric propulsion in certain restricted areas, there remains but one self-contained power plant that will meet the demands of service and economy in this land of great distances and low unit costs of transportation. Nor will we, doubtless for years to come, see aught but the occasional supersedence of the steam locomotive by the electric or internal combustion engines. Hence it is all the more essential that the details of the steam locomotive be so carefully studied, improved and perfected as to hold its well deserved prestige, yet so modified as to overcome its deficiencies.

E. W. Pratt
President, Master Mechanics' Association

The past year has witnessed the almost universal use of the superheater and brick arch, but the refinements of the former are only just commencing.

The high temperatures of steam have brought into more extended use the force feed lubricator, which is quite general in European locomotive practice, and it would not be inappropriate for this association to have a committee whose duty it would be to keep in touch with the developments therein, collect data and make yearly reports.

There is evidenced a halt in the strife for larger and still more powerful locomotives of the articulated type, and yet the perfection of the mechanical stoker has increased the human imitations so that some cause other than the inability to fire the boiler must be sought as the reason. Perhaps the articulated locomotive was only the means to an end which may now be accomplished in other ways. The floating or radial driving axle, in conjunction with the two-wheel truck or the trailer working in synchronism, practically performs the functions of a four-wheel truck in guiding the locomotive, thereby reducing the rigid wheel base of a ten-driver engine to that of an eight or six. This principle gives promise of an engine of 100,000 lb. tractive effort, or more, without resort to the Mallet or triplex. There is indeed great promise in this floating axle scheme, or some development thereof, although it require a change in the restricted side play now permitted by Federal rule and agreement.

The use of multiple cylinders for compounding was halted

somewhat by the equal and easier economy effected by the superheater, yet who shall say that the ideal of "compounding in one cylinder" may not be reached in the avoidance of condensation by superheat? Already there are designs for a large freight locomotive that is unique in many respects and is intended to accomplish this. The cylinder will be relatively long, the boiler pressure and superheat high, and the maximum starting effort of over 80,000 lb. based upon approximately one-half stroke cut-off.

There has been further progress in locomotive design in the way of giving greater attention to refinements, and the tendency to reduce the weight of reciprocating parts and

William Schlafge
First Vice-President, M. M. Association

running gear is noticeable, but not to the fullest extent nor equal to the results obtained in the automobile field. An expert designer has calculated that the heaviest and most modern 2-10-2 type locomotive could be reduced in weight 7,000 lb., or the equivalent of a boiler two inches larger in diameter, by the use of carbon-vanadium steel (not heat-treated), which can be purchased in billet form at one cent per pound premium and forged in any locomotive shop, requiring only annealing.

The development of the film feed-water heater and the possibility of passing 60,000 lb. of water per hour through such a device of a size small enough to be made practicable on a locomotive, gives rise to the belief that a marked economy may be effected thereby; for it has been demonstrated that an increase of every eleven degrees in temperature will represent an economy of one per cent. The boiler being the limiting feature of the modern locomotive, no pains or expense should be spared to effect its improvement, and it is in that line that the greatest advancement in the art of locomotive engineering is to be expected.

The report of the committee appointed by the Chicago Association of Commerce on smoke abatement and electrification of railway terminals, extending over a period of four and one-half years, was presented to the public during the past year and is probably the most elaborate ever made on this subject. In brief, the conclusions reached are that the complete electrification of the steam railway terminals of Chicago would cost not less than $275,000,000, and is financially impractical under present-day conditions; and that although great progress has been made in recent years toward reducing the smoke from steam locomotives, the maximum results have not yet been attained. While the electrical engineer has tremendous and difficult problems to meet in the enormous first cost for installation, extraordinary fixed charges and relatively low load factor, he is making rapid strides with respect to reducing the cost per kilowatt-hour by power plant improvements, and the steam locomotive must forge ahead quite rapidly in order to maintain its prestige. Through the limitations of clearances the boiler is the controlling factor in the development of the steam locomotive, and while we should produce the maximum hauling capacity per unit of total weight at the minimum cost per pound of drawbar pull, consideration must also be given to the problem of bringing about a greater heat value per cubic foot of the limited firebox volume. Then by the direct means of higher boiler pressure, increased efficiency of evaporating surfaces, more perfect combustion, more uniform firebox temperature and steam pressure, improved circulation, feed-water heated by gases and waste steam, higher degree superheat, and systems of compounding in one or more cylinders to reduce back pres-

F. H. Clark
Second Vice-President, M. M. Association

sure, we will be able to place steam on a parity with electric operation.

In his address a year ago your President referred to the experimental work then being done in the use of pulverized fuel. During the past year further applications of this method of burning solid fuels have been made, the railway with which I am connected having equipped one of their existing superheated steam Atlantic type passenger locomotives, which is now and has been for some time performing service between Chicago and Milwaukee on some of the fastest regular schedules in the world. The Delaware & Hudson Company has recently purchased, so equipped, a new consolidation locomotive which is the largest of that type. The Missouri, Kansas & Texas is now equipping a ten-wheel passenger locomotive for burning powdered fuel, and several other applications are in progress. Up to the present various grades of bituminous coal, lignite, and a mixture of bituminous and anthracite coal have been used successfully in these experimental locomotives. The results obtained from the use of pulverized fuel in locomotive service may be briefly summarized: cinderless, sparkless and smokeless operation; maintenance of maximum

boiler pressure at all times without loss at the safety valves; increased boiler efficiency due to the high temperatures obtained; saving in fuel; the elimination of arduous labor on the part of the fireman, and of delays and expense at the ashpit.

It seems now quite probable that the public demand for the elimination of the smoke, cinders and sparks, the desirability of giving a value to what is now a waste product of mining, the growing scarcity of fuel oil, and the prohibitive cost of briqueting, will, in combination with this method of increasing the effectiveness of steam boiler operation, afford as great an opportunity for reducing steam railway cost of conducting transportation as has the use of superheated steam.

The improvement of old locomotives by the application of superheaters, brick arches, improved valve gear and other modern apparatus, and even rebuilding with larger boilers and these appliances, is still going on. All these refinements, as well as the substitution of heavy new power and the retirement of old smaller locomotives, have had and will continue to exert a marked influence toward the decreased cost of conducting transportation, for which often too little credit is

W. J. Tollerton
Third Vice-President, M. M. Association

given the mechanical department, whereas it should be borne in mind that these changes continually produce an increase in the charges to maintenance of equipment for which the mechanical officers of railways are held directly responsible, particularly so when the unit of measurement used is the cost per locomotive-mile. Why should this unit be adhered to instead of one based upon the work performed—the cost per thousand ton miles, or a still better unit based upon the tractive effort? When we consider the great increase in the size of locomotives and in the cost of material and in the wages of shop men, I feel that the mechanical department men have done exceedingly well to keep the costs per locomotive and locomotive-mile from advancing more rapidly than they have.

One of the most vital questions for us today is the standing of the motive power officer with respect to business questions. Does this department initiate data of value to create a feeling of dependence on the part of the management of the road? Does this department have a knowledge of its costs in order to show what it gets for a dollar and to check waste and extravagance? On most roads the cost of doing a given piece of repair work at different shops varies so widely as to suggest lack of appreciation of the value of keeping costs on a reliable basis. Every motive power superintendent should know the cost of his department and the effect of his work upon the earnings of the road. If motive power officers and their managers would take the time to investigate the careful methods of obtaining costs in commercial manufacturing institutions, they would readily see the value of similar data to a railroad. No such commercial institution could hope to succeed without such accurate information. By it they can show conclusively the commercial advantages of discarding obsolete machinery in old and inadequate buildings, and installing

Angus Sinclair
Treasurer, M. M. Association

new machinery in new buildings, with all the modern facilities for cheap and quick output. It has been years since this association has had a paper on shop lay-outs; yet we have among our membership experts in that line, and I would suggest a paper thereon for another convention.

Railroading is the largest industry in this country except farming, yet it is not to be doubted that other manufacturing plants of less magnitude spend far more money for shops, tools and machinery. How frequently do we find manufacturing establishments with their buildings, tools and equipment 30 or 40 years old? Yet this is not at all unusual for a railroad shop or roundhouse, where often you will find not even sufficient expenditure on machinery to offset its depreciation. Why should we not obtain the necessary data and present it in such a way as to force attention and action? Perhaps by improved facilities the cost of repairs to locomotives could be kept from advancing in leaps and bounds. Every railroad with numerous shops should have standard practice cards to insure uniformity at all shops, and where the facilities are inadequate to produce finished material at a reasonable cost, this work should be concentrated in one or more of the larger shops, and the material distributed from there ready for use, or nearly so.

One of the progressive features of this Association is the recent increase of standards and specifications. If this work were continued and amplified and generally followed by the members, it would result in vast economies as compared with a specification wherein every item is a specialty. Every motive power officer should exert his influence in the direction of more rational methods of adopting new designs. Too much of this work is done over night. When a road is to have

a new freight engine, of perhaps a new type, a sample engine ought to be built and run for some time on the road before purchasing a large number. Too often there is less time spent in the design of the intricate details of a locomotive than in those of a new freight car, where a sample car is first built and tried out.

It would be difficult to estimate the amount—suffice it to say it is large—which is expended annually by the railroads for experimental work. Much of this work cannot be done in road service with any such degree of accuracy or economy as is possible in a laboratory plant. It is my suggestion that this Association should co-operate with one or more universities having an elaborate locomotive testing plant, and have them prove out all such new appliances offered to railroads as could best be tested under constant laboratory conditions, giving the results of their investigations to the members. This Association, with the financial backing of the railroads, could afford to employ some first-class man to supervise these tests and experiments, and incidentally this work would be of inestimable value to the students of such univerities.

So many changes have taken place in the locomotive since this Association tested out and promulgated its standard front end arrangement that I cannot but feel that something should be done with respect to modifying the same in connection with superheat. Easier lines of draft should be provided for, similar to European practice, thereby permitting the use of a greatly increased size of nozzle and consequent decrease in cylinder back pressure.

The possibilities for economy are so great from flange lubrication, and the apparatus therefor so multiplied within the last few years, that I would recommend that a committee be appointed to again present this matter to this Association. Another committee on Cylindrical vs. Rectangular Tanks would perhaps advance the more general use of a design cheaper in first cost and maintenance.

This year a start has been made toward the guidance of the work of the various other railroad mechanical department associations, such as the Air Brake Association, the Traveling Engineers' Association, the Master Boiler Makers' Association, the General Foremen's, Tool Foremen's, Blacksmith Foremen's and Master Painters' Associations, etc., in order to eliminate much duplicate work on their part and particularly to bring about the adoption by the railroads generally of such of their findings as are of special value. I believe these various associations can and should be made valuable adjuncts of this Association, and that our committee should be continued and asked to devote much time and attention to the matter, so that they will ultimately become the "steering committee" of the work of these associations, to the mutual advantage of them and ourselves.

I would feel derelict in my duty did I close without a word on the training of men both for mechanical positions and for promotion. It is not sufficient to merely train men—you must have a promotion scheme which will enable you to keep track of them and promote them intelligently and wisely. Many a road has ideal systems of standards and design, but no definite plan of training and promotion of the men who are to be its officers in charge of the ever more complicated details of large affairs, and these men should be so broadened with experience and instruction that they may be able to handle such matters commensurate with their importance.

The greatly increased cost of material has given an impetus to the reclamation of old and usable material by various and ingenious methods, and I believe a live paper or committee report on this subject would be a valuable addition to our proceedings.

During the past year the Federal inspection rules have been extended to cover other parts of the locomotive than the boiler, and it is already apparent that unless wisely administered this is going to cost the carriers large amounts of money; nor is it at all certain that these rules and the older boiler inspection rules, all of which were adopted as compromise measures between the railroads and the Federal authorities, are so wise that some revision, particularly in the time limits of the latter, would not be proper and result in saving much expense without jeopardizing the safety and security of employees and the public.

In thanking the officers and committees who have served the Association so faithfully during the past year and performed their every duty promptly and well, may I be pardoned for drawing attention to the fact that every committee report was in the hands of the members 30 days ago, an accomplishment unprecedented in the annals of the Association?

It has not been infrequent for your presiding officers to urge upon the younger members their active participation in the affairs of this Association. Perhaps this is starting at the wrong end. Possibly each officer in charge of a mechanical department should tell his men, in words plain and unequivocal, that he wants them not only to learn all they can by their attendance at these conventions, but also to contribute of their experience for the benefit of others. I would feel that more good had been accomplished for the future of this Association, and I would therefore be more pleased if it could be said at the close of this convention that every member present had made a few remarks on some subject, than were it said that a few of our most proficient orators had discoursed never so eloquently.

When I first attended these conventions I was told by a wise counselor that I must take some part, no matter how small, in the discussions. In following that advice in this and other associations I can say positively that it has benefited me greatly. I believe this Association owes it to the young railroad men of the country to get them into active work in the committees, in the discussions and in the preparation of individual papers. This Association could well undertake to bring out the young men, compelling those who know things of value to come out and spread what they know for the benefit of all. Sometimes it is the best thing possible for a young man to try to write a paper on a subject; he finds out how little he knows about that subject, and immediately begins to fortify himself. The Committee on Subjects and the Executive Committee should give great consideration to this matter and search out our young men and make them work. The life of a nation is in its youth; the future of this Association is in its young men—may they not be found wanting.

In closing I would pay a tribute to the unostentatious efficiency of the mechanical department. During the past year peak loads have been experienced in the railroad traffic of this country and Canada, notwithstanding the fact that locomotive building has been almost at a standstill for two years past. How could this have been accomplished except by all working faithfully, well supported all the way down the line by a loyal and efficient organization. May the present move of prosperity continue, and may the mechanical departments of our great railroads derive such benefits and improvements as is their just due.

Secretary Taylor presented his report, which showed that the membership of the association at the present time consists of 907 active members, 96 representative members, 20 associate members and 44 honorary members. The receipts of the association for the past year were $11,192.40, and the disbursements $11,123.00, leaving a balance of $69.40.

Secretary Taylor stated that the students who attended Stevens Institute of Technology under scholarships of the association during the year 1915-16 were Walter S. James, class of 1916; Harold W. Alling, class of 1918, and Royal C. Bundy, class of 1919. Walter S. James graduated June 6, 1916. The young man who has held the Ryerson scholarship has retired and there are applications from six candidates for that scholarship.

The treasurer's report showed a balance on hand of $1,560.08. Both reports were referred to an Auditing Committee composed of the following members: H. C. Manchester, C. M. & St. P.; G. M. Basford and G. E. Parks, M. C.

The recommendation of the Executive Committee that the dues of active and associate members be fixed at $5 per year, and those of representative members at $7 per year per 100 engines, was adopted.

An amendment to the constitution, proposed last year, changing the procedure of elections, was adopted. This provides for voting by ballot during one of the regular technical sessions.

W. H. Corbett, of the Michigan Central, representing the Traveling Engineers' Association, was invited to attend the sessions of the Convention and was accorded the privileges of the floor.

In order to increase the number of representatives of locomotive builders in the association an amendment to Article III, Section 1, Paragraph 3, of the constitution was proposed by the Executive Committee. The amended paragraph reads as follows:

"Two (or more at the discretion of the Executive Committee) representatives from each locomotive and car-building works."

Report of Committee on Mechanical Stokers

The Committee on Mechanical Stokers has been in existence for some years under the chairmanship of Alex. Kearney, assistant superintendent of motive power of the Norfolk & Western, a road which has had a great deal of experience with the mechanical firing of locomotives by most of the machines at present in use. The progress in the development of the stoker is shown very clearly by the figures in the report which give the number of the various types in service for every year since 1910. It is interesting to note in the committee's report the opinion of its members as to the probable lines to be followed by the future development of the mechanical stoker; also the opinion that the full development of the mechanical stoker has not by any means been reached. In addition to the Norfolk & Western, the Baltimore & Ohio, the Chesapeake & Ohio and the Pennsylvania Lines are all large users of mechanical stokers, and all three roads are represented on the committee.

Besides the chairman, the committee consists of M. A. Kinney, superintendent of motive power, Hocking Valley; J. R. Gould, superintendent of motive power, Chesapeake & Ohio; J. T. Carroll, assistant general superintendent of motive power, Baltimore & Ohio; J. W. Cyr, superintendent of motive power, Chicago, Burlington & Quincy; A. J. Fries, assistant superintendent of motive power, New York Central; L. B. Jones, assistant engineer of motive power, Pennsylvania Lines West.

THE committee a year ago shared the opinion of the Executive Committee that it probably would be interesting and none the less valuable if further data could be secured (preferably on a laboratory test plant) to show the relative efficiency of at least the prominent types of locomotive stokers, using the different grades of fuel under the usual range of operation. However, the committee now feels confident that it would be better and very much more satisfactory in the end to postpone the work until the machines more nearly approach standard designs.

Furthermore, the stoker field is gradually narrowing itself down to a few types. Those that have withstood the storm and continue to show merit are practically embraced in the Street, Hanna, Standard and Crawford machines; at the same time even these machines are undergoing alterations for higher efficiency and greater range of adaptability, though not necessarily departing from the general principle upon which the machines were originally laid down.

As of April 1, 1916, the following number of machines of the four named types were in service and on order:

	In Service as of April 1, 1916	On Order as of April 1, 1916
Street	866	152
Crawford	413	63
Hanna	39	39
Standard	100	125
Total	1418	379

In order to show the headway made in stoker designs and improvements during the past four years records of those in service have been prepared as shown in the tabulation in the next column.

Generally speaking, the progress in the stoker designs during the past year has been quite encouraging. Since our last report the Locomotive Stoker Company has brought out their Duplex machine, which has for its object the conservation and efficient utilization of a greater amount of the finer product in the fuel heretofore subject to more or less loss with any of the scatter type machines.

Much time is being devoted to the study of pushing coal through open and closed ducts and troughs, to ascertain the range of possibility and necessary mechanical conditions, also the effect of grinding and further pulverizing the fuel in its passage from the tank to the fire box through the helicoid screw in the horizontal or vertical planes, as well as the general effect through the pressure zones, the fruits of which it must be realized can only be obtained as developments are carried forward.

STOKERS IN SERVICE 1910-1916.

Year	Street	Crawford	Hanna	Standard	Total
1910	5	1	...	...	6
1911	10	1	1	...	12
1912	165	46	1	...	212
1913	173	153	2	...	328
1914	418	301	3	2	724
1915	531	301	18	22	873
1916	866	413	39	100	1418

The Street Company's regular type *C* stoker, like other machines on the market, continues to do excellent work, and is showing improvement in durability. The Street Company has recently designed and constructed two machines of a type known as their Duplex, one of which has been applied to a Mallet engine on the Norfolk & Western, and the other to a locomotive of a similar type on the C. & O. Railway.

The Hanna and Standard companies have both been pushing with much earnestness the introduction of a number of

detail improvements in their machines for greater durability of parts, as well as higher efficiency in their operating engine and controlling mechanism.

We are informed that many improvements in detail have been made in the Crawford stoker which forecast substantial progress, efficiency in operation, and lower cost in maintenance.

By the time the present machines reach a more favorable stage for a comparative test the opportunity for such an investigation, which at best is going to be very expensive and require a great deal of time, may be more opportune than at present.

DISCUSSION

Mr. Kearney: In addition to the two Duplex stokers referred to in the report, I am advised that there has been a third applied to the Burlington. The Duplex machine on the Norfolk & Western is a very attractive design. We have had it in service for a week or so and it is doing very good work. I was on it a few days ago for a little run of about 35 miles on a fast freight. I had no criticism to make, except that it made too much steam. The controlling apparatus was not perfected. The Duplex machine is very interesting because it possesses so many features not common to the other scatter-type machines. The scatter-type stoker manufacturers are apparently beginning to realize that there are certain principles they can adhere to with safety. For instance, the Street, Hanna, Standard and the Duplex just mentioned utilize the screw from the tank to the engine. They all have the screw in a horizontal position and they deliver the fuel from the tank to the boiler head. The Duplex uses a horizontal screw, but instead of elevating the coal through one vertical screw it is carried up through two, one to either side of the door.

As for the efficiency of the stoker, if I were asked to define what was meant I would have to ask whether we were comparing with hand-fired or stoker-fired engines. When we begin to work on the efficiency of a stoker we must compare it with something. In our last year's report we prepared some data to show the relative efficiency of hand firing as against stoker firing. There we pointed out that the efficiency of the stoker was very largely dependent upon the per cent of finely divided fuel in the product. That portion is necessarily carried through the tubes, out through the stack, thereby reducing the net efficiency.

It is, of course, true that in hand firing we may attempt to compare a stoker-fired engine that could not be satisfactorily hand fired. Therefore, in any comparison we would have to first assume that the stoker-fired engine could be satisfactorily hand fired and would satisfy the service. In the stoker we can go beyond that and handle fuel at a faster rate than we could hope to handle it by hand. The committee believes that it would be inadvisable to make any efficiency test at this time, or until the stoker designs have more nearly come together. All of the stokers during the past year have gone through many changes. As soon as they reach a permanent stage it will be time enough to attempt comparative tests.

J. Snowden Bell: I understand that some applications had been made of the Gee stoker. I would like to ask whether there is any performance of the Gee stoker to report. I am informed that a mechanical stoker of the shovel type is now in course of construction, in which there are two swinging shovels. The coal is thrown into the firebox in the actual manner of the fireman.

Mr. Kearney: The Gee stoker was discussed in our earlier meetings, but we were advised that nothing had been developed during the past year.

With reference to the shovel type stoker, the committee has advice that such a stoker has been designed, and I understand it is about developed.

C. B. Young, (P. R. R.): The Gee stoker has not been in operation for over a year.

G. M. Crownover, (C. G. W.): During the last year the Chicago & Great Western have installed one Standard stoker on a Mallet type engine. This stoker was selected on account of being able to fire run-of-mine coal. The stoker worked successfully all the way through the season. By the use of the stoker we were able to haul the capacity of the locomotive at all times and were able to get along during the hot summer days without having a relief fireman. It was beyond human endurance to have a fireman go over the division on which the Mallet engines were running, 116 miles long.

The only difficulty we experienced with the stoker was in extreme cold weather, when the frozen lumps of coal would break the worm in the feed. That has been remedied by making the worm stronger.

We also equipped one locomotive with the Hanna stoker. So far as the merits of the two stokers are concerned I cannot say that there is much difference. We did not find that there was any particular saving in fuel; there was not enough difference so that we could make a record of it.

G. W. Rink, (C. R. R. of N. J.): I would like to have the committee give us some idea of the state of the art in the application of stokers to the wide-firebox, double-door engines, using bituminous and anthracite coal, with grate areas of 80 to 90 sq. ft.

Mr. Kearney: I have had no experience with the double-door, wide-firebox engine, but we are about to apply the Hanna type and the Standard type stokers to a firebox 8 ft. wide by 10 ft. long. We do not anticipate any trouble at all on account of the distribution of coal in the corners. The brick arch is used in all stoker engines.

J. H. Manning (D. & H.): We made an application of the Street stoker to a wide firebox engine with 100 sq. ft. grate area burning small anthracite coal. We found that it did not go very well without the arch, and the difference betweeen the bottom of the bottom tube and the top of the grate was so small that we could not apply an arch well. However, we put in a portion of an arch and finally had to take it out.

C. F. Street: Since the stoker was removed from the D. & H. we have put 10 Street stokers on the Philadelphia & Reading, with fireboxes 9 ft. wide and 12 ft. long, without a brick arch, merely having a bridge wall in front of the combustion chamber. We have been firing 10 of those locomotives with 75 and 80 per cent anthracite coal and 25 per cent bituminous. On the Lehigh Valley, with 100 sq. ft. of grate area and almost the same width of firebox, we are firing 50 engines with the brick arch. There is no difficulty of covering the grate with authracite or pure bituminous. We prefer the single door. We are using the double door on certain of the locomotives, and the single large oval door on others. It was no small job to cover a grate of this size, but we have accomplished it on 10 locomotives, and are putting the stoker on 20 more engines on the Philadelphia & Reading.

Mr. Pratt: What is the length of grate used?

Mr. Street: Twelve feet. We use the entire grate.

I. A. Seiders, (P. & R.): The Philadelphia & Reading placed an order during the month of November for ten Street stokers to be applied to anthracite burning engines, having a firebox 9 ft. by 12 ft. On account of the construction of the stoker, it was necessary to use the single door. We received the engines during the severe weather in January, and we had but a few failures with the stokers. I dare say we went a little better than 75 per cent. anthracite. We had some men fire them 100 per cent. The average was between 75 per cent. and 90 per cent., and we have been successful with very little supervision. New men did as well as the older men. In firing anthracite coal, with the proportion of 25 per cent. bituminous, we have used rice coal, buckwheat coal and at times have had to resort to pea coal, getting about 90 per cent. stoker firing.

Mr. Crownover: We found that the arch was a benefit.

After trying it both ways we found that the arch tended to save fuel.

John Purcell, (A. T. & S. F.): The Atchison, Topeka & Sante Fe, has one of the type C Street stokers, and we have found we have much better results with the arch. So far we have had practically no failures.

Wm. Schlafge, (Erie): We will have in service in about 30 days, a total of 58 stoker-fired engines and now have 32 in service. Of the total 41 will be equipped with the Street stoker and 17 with the Hanna stoker. These engines are operating on a 112-mile division, the grade running all the way from 50 to 65 feet per mile. The tonnage rating is 2700, consuming from 20 to 25 tons of coal, depending on weather conditions, time on the road, and grade of coal. So far as we have had as near 100 per cent. service as could be asked with the Street stoker. The Hanna stoker which is on five engines has not been in service long enough to say anything about yet. In the next 30 or 60 days we intend to conduct a dynamometer test to determine the relative efficiency of the stokers, and I think we will be able to furnish the stoker committee of next year some information in that respect.

J. A. Pilcher, (N. & W.): No new engines are being built on the Norfolk & Western without stokers. There has been no decision as to the type yet, because we have been getting some of the various kinds on each order and all that we are handling are doing business. From my own standpoint I have been very anxious that some decision be reached as to which one is the best, but while it may be very trying to those who have to keep a record of the details of construction, it might not be very well to stop progress by adopting a standard just at this time. There may be others yet to come besides the developments that have taken place. In applying some new Duplex and Street stokers we found that the stoker engine was interfering with the spring and had to weld on another piece to strengthen the spring supports; so you see we are still having trouble with the stokers.

Professor L. L. Randall, (Virginia Polytech. Inst.): There is one point which I would like to bring out in regard to the stoker. It is extremely difficult, and a great deal of time is wasted in attempting to make a scientific investigation of an apparatus of this kind when it is first starting out. There are many things, like the stoker engine getting into the spring, that anybody can see are wrong. Until those things are tested and worked over, one after another, it is a waste of time trying to do anything scientifically. It will pay to go into the development exhaustively before attempting in any way to decide on a standard.

J. A. Anderson, (B. & O.): On the Cleveland division we have 27 stokers; in fact all of the engines on the heavier freight service are equipped with stokers. Matters have gotten so now that we feel we cannot get along without them. The only things now desired are the matters of simplifying the stokers and decreasing the number of parts.

D. F. Crawford, (Penna. Lines): We have 400 stokers in service, and we are building 50 or 60 more. All that has been said about the difficulty of developing the stokers I will agree to. I find that there are a good many things to think of, and a great many things we do not think of in time. The results obtained and the opinions of the men in actual charge of the operation of the locomotives are such that the management of the company feels warranted in continuing the development of the stoker, because I feel that we are only in the developmental stage.

F. H. Clark, (B. & O.): We have about 275 stokers in service at the present time, and more on order; we appear to be getting on very well with them.

C. A. Kothe, (Erie): The firemen take to the stoker very rapidly and very successfully, and we have had very little trouble.

J. R. Gould, (C. & O.): We have 140 stokers in service; 135 Street and 5 Hanna. They are doing the work thoroughly, filling the bill in every respect, and we are using them not only in freight service but in passenger service. On our heavier passenger engines, we would not be able to handle the trains we are now handling and keep them on time, without the stokers.

C. F. Street: The Street stoker today is a fully developed machine. We have going through the shop 300 machines. We have in the storehouse material for 400 additional machines. These will all be exact duplicates of and interchangeable with every machine we built last year, and exact duplicates and interchangeable with every machine we built the year before last. The Street stoker is firing over 1,000 locomotives.

We have a record of 30 stokers firing 30 locomotives an aggregate of 1,000,000 miles, without a single case of failure.

We are developing a Duplex machine and have the first one out. The development of the Duplex stoker will probably be a long drawn out proposition, but the information we have gained from the Street stoker will enable us to develop any other stoker in much less time.

It has always been my opinion that the stoker has enough to do to fire the locomotive, without preparing the coal for its use, and while I may some day have to change this opinion, I cannot see the slightest reason for doing so at the present time. When you put run-of-mine coal in the stoker, and this would be a great advantage, you sacrifice other and more important features. The most important of these is the reliability of the machine. A stoker which takes run of mine coal is essentially less reliable than one which takes prepared coal. We always recommend an arch in connection with the stoker, and it is only when we are compelled to do without it, as we were on the Philadelphia & Reading, that we do not use it.

D. D. Arden, (Savannah & Statesboro): As we are trying to use the dust in the coal today, I would like to know what effect the water will have on dust going through the stoker.

A. Kearney: We have tried that in some of the stokers and it worked very successfully. All understand that the effect of putting water on the finer coal is an advantage under certain conditions. There are stokers that handle that condition very satisfactorily. I am not sure that the Street stoker will always clear itself under conditions of that kind.

Last year the committee was asked to make some laboratory tests in order to determine the efficiency of the stoker under the ordinary operating conditions. The committee would like very much to attempt something of that kind, but it is going to be an enormous and an interminable job to test out the stokers under the varying conditions of fuel. It is just about as difficult as it would be to test out a lot of firemen with the various kinds of fuel. I hope we will be able to get some information pointing to an efficiency test, but just now I do not know how it can be obtained. The scientific part of the stoker firing is one that we will have to go into a little later.

Confining ourselves for a few moments to the scattering type machines, the stoker is not a fuel saver. As the amount of fine coal is increased, just so fast will the efficiency of the stoker fall off. In the Standard, the Street and the Hanna stokers, as well as the Duplex, the coal as it enters the firebox is practically in the same physical condition, so that they are all prepared fuels. What is going to be the effect, or is the effect, of the height at which the coal is delivered to the firebox, is going to be a very nice and interesting determination. The Street stoker delivers its coal a little above the firebox door, and to either side, but by reason of the deflectors the fuel is thrown down towards the bed of the fire and under the arch. In the Hanna stoker the fuel is delivered at the top portion of the door and is given an upward throw. The Standard throws its fuel on the line of the firebed. What effect the relation of these three directions

will have on the amount of fuel going out of the firebox is something we will in time have to determine. We all know the quantity of coal passing through the firebox. I want to make it clear that I do not think that it is at all times consumed, because we have gotten coal from off the top of the locomotive cab containing as much as 13,000 B. t. u. The evaporation, as shown in last year's report, drops off very rapidly as the quantity of the finer product increases.

Revision of Standards and Recommended Practice

The committee this year presents six subjects for the approval of the Association by letter ballot. Perhaps the most important subject considered during the past year is the standard pipe union, in which it was found from data presented that the standard of the Association is more logically designed than any of the other standards on the market. It is suggested by the committee that a committee be appointed to meet jointly with the committees from the Master Car Builders and the American Society of Mechanical Engineers to develop details for the ball joint standard pipe union. This committee is also working on the subject of tolerances and fits for screws, nuts and taps. It has had representation, during the past year, on a committee of the American Society of Mechanical Engineers, which is studying this problem. The subject of practical allowable variations from actual standard construction is under consideration.

W. E. Dunham, Chairman

W. E. Dunham, supervisor motive power and machinery, Chicago & North Western, is chairman of the committee. The other members are: M. H. Haig, mechanical engineer, Atchison, Topeka & Santa Fe; A. G. Trumbull, assistant to the general mechanical superintendent, Erie; C. D. Young, engineer of tests, Pennsylvania; G. S. Goodwin, mechanical engineer, Chicago, Rock Island & Pacific; R. L. Ettenger, chief mechanical engineer, Southern, and E. B. Milner, engineer of motive power, New York Central.

The committee submitted the following report:

[Only the most important changes which were approved by the committee are given below.—Editor.]

JOURNAL BOXES, BEARINGS AND WEDGES. (Standard.)

For Journals 5 in. by 9 in. Sheet M. M. 8.
For Journals 5½ in. by 10 in. Sheet M. M. 11.
For Journals 6 in. by 11 in. Sheet M. M. 15.

A member calls attention to the dimensions giving the depth of the clearance in the under side of the top of the box for the upward projecting lugs at the front of the wedge and suggests that this depth should be indicated by a definite figure instead of being a relative one dependent upon the upward taper toward the lid opening.

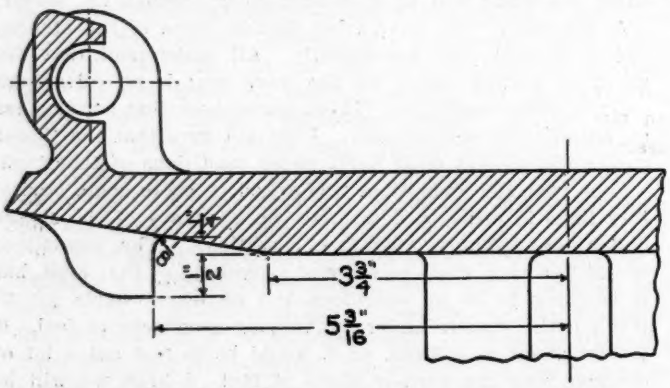


Fig. 1.—Showing Clearance in Top of Journal Box

The committee concurs in the recommendation and suggests that the dimension of ¼ in. be added to these sheets as shown in Fig. 1.

For Journals 5 by 9 in. Sheet M. M. 8.

A member suggests that the note regarding the journal box be changed to conform to the wording of the note on Sheets M. M. 11 and 15, showing boxes for journals 5½ by 10 in. and 6 by 11 in., and permit the journal box being made of pressed or cast steel.

The committee concurs in the suggestion.

SPECIFICATIONS FOR 33-IN. CAST-IRON WHEELS.

(Recommended Practice.)

Pages 491-494. Sheets M. M.—E, F and G

A member suggests that the specifications for cast-iron wheels should specify definitely the limiting maximum brake load per wheel, so as to avoid excessive heating of the wheel.

Your committee concurs in the suggestion and recommends that this committee be authorized to work jointly with the Car Wheel Committee of the Master Car Builders' Association in arriving at the proper braking loads for the several standard weights of wheels.

PIPE UNIONS. (Standard.)

Page 547. Sheet M. M. 19

A member presents tabulated and diagrammatic studies of the principal dimensions of the interchangeable parts of the various makes of pipe unions as found on the market, and shows that there is practically no interchangeability. Data are also presented which indicate that the Standard Pipe Union of this and the M. C. B. Association is more logically designed in detail than any of the present manufacturers' standards, with the exception, possibly, of the threading in the nut of the ¼-in. ⅜-in. and ¾-in. unions. He proposes 14 threads per inch instead of 18 for the ¼-in. and ⅜-in. unions and 11 threads per inch, instead of 14 threads for the ¾-in. union.

He also proposes branding the union "A. R. M. M. A."

The committee concurs in the suggestions. Also the committee recognizes the desirability of interchangeability of the several parts of pipe unions. This should include the type of union known as the "ball joint," which is not covered by an Association Standard. The committee recommends a joint committee of the Master Car Builders, the American Society of Mechanical Engineers, and the American Railway Master Mechanics to develop details for the "Ball Joint" Standard Pipe Union.

NEW BUSINESS

A member suggested that the Rules and Instructions for Inspection and Testing of Steam Locomotives and Tenders as ordered by the Interstate Commerce Commission, October 11, 1915, in accordance with the Act of Congress of March 4, 1915, should be adopted as a Standard of the Association. The committee concurs in the suggestion.

DISCUSSION

Mr. Pratt: The committee makes two recommendations, one being to the effect that the Committee on Revision of Standards and Recommended Practice work jointly with the Car Wheel Committee of the Master Car Builders' Association. At the convention of the Master Car Builders' Association a motion was passed that the Train Brake and Air Signal Committee work in conjunction with this committee of the Master Mechanics' Association and the same committee in the Master Car Builders' Association. A motion

will be in order to concur with that action, and let these three committees work together, it being undoubtedly a fact that the brake pressure on the wheel has as great an influence, if not greater influence, than the weight of the wheel on the rail.

(A motion was made and carried.)

Mr. Pratt: The committee recommends a joint committee of the Master Car Builders' Association, the American Society of Mechanical Engineers, and the American Railway Master Mechanics' Association, to develop details for the ball joint standard pipe union, and to review the present standard details, if found necessary, and to present to the manufacturers the economic necessity for interchangeability, this committee to invite the manufacturers to this conference.

(A motion was made and carried.)

The paragraphs in the report recommended for that action by the committee were referred to letter ballot.

Dimensions for Flange and Screw Couplings for Injectors

This subject was first brought to the attention of the Association in an individual paper on "Flange and Screw Couplings for Injectors," by O. M. Foster, master mechanic, Lake Shore & Michigan Southern, which was presented before the 1914 convention. The recommendation of the author was adopted and the above committee appointed to report at the next convention. The report presented a set of proposed standards covering the form and number of threads and the dimensions of sleeves, coupling nuts and flange couplings. Owing to some question as to the advisability of using a single standard of 10 threads per inch for all sizes of pipe considered, the committee was continued, and after further consideration has confirmed its previous recommendations. It therefore now becomes a matter for the Master Mechanics' Association to decide to refer to letter ballot for adoption as a standard.

M. H. Haig, Chairman

M. H. Haig, the chairman of the committee, is mechanical engineer of the Atchison, Topeka & Santa Fe. The other committee members are T. F. Barton, master mechanic, Delaware, Lackawanna & Western; W. A. Winterrowd, assistant to chief mechanical engineer, Canadian Pacific; B. F. Kuhn, assistant master mechanic, New York Central; S. B. Andrews, mechanical engineer, Seaboard Air Line; M. D. Franey, and J. C. Mengel, master mechanic, Pennsylvania Railroad.

The report of the committee, presented before the 1915 convention, was referred back to the committee for further consideration. The original members of the committee were continued and the committee was enlarged by the addition of two new members. After further and careful consideration, the committee confirms the report presented at the last convention.

Because of the difference in size of couplings and number of threads used by the several manufacturers, it is not possible to select a set of common standards which will interchange with all the individual standards of the several manufacturers. Realizing this, the committee selected a set of dimensions representing practices most common to the greatest number of railroads and based its original report on these dimensions. There is no doubt that the proposed dimensions are thoroughly satisfactory in providing for mechanical strength and in meeting all injector conditions, for a large proportion of the roads are now using couplings conforming practically to the dimensions proposed.

It is not unusual for the principal manufacturers to make injectors to suit connections of different standards, and at least some, if not all, of the manufacturers now have injector connections in service which will interchange with the proposed common standards.

In presenting the report Mr. Haig said: I would like to review in brief some of the information presented last year. The pitch of thread for injector couplings reported as used by the greatest number of roads is 10 per inch. Couplings made by different manufacturers and having approximately the same diameter as well as the same pitch of thread will largely interchange at present. It was, therefore, decided that a thread adopted as standard should interchange with either the V-thread or with the United States standard thread, and a modified form of the United States thread will meet this requirement, and is suggested as the proposed standard. These threads are proposed for all injector connections, including the overflow, as well as for all couplings used throughout the injector piping system, whether of the nut or flange type. The report of last year shows the proposed standard form and dimensions of thread for injector couplings. Where the flange coupling includes the thread the same thread can be used as with the spanner nut.

DISCUSSION

C. D. Young, (P. R. R.): I think it would be a mistake at this time to present the recommendations of the committee to a letter ballot for recommended practice, for the reason that we would be anticipating the joint action of other committees on practically this same subject, which committees are reviewing the threads, the number of threads, and the pitch diameter on pipe unions. Furthermore, the present standards of our association in regard to pipe unions are to have a different dimension and thread and number of threads per inch than those which were proposed in the report of this committee last year, which involve the carrying of two sets of stocks and dies in the tool room for doing the same character of work. It would be preferable to have this matter handled by the joint committee of the American Society of Mechanical Engineers, the Master Mechanics' Association and the Master Car Builders' Association. Whatever they agree on as the diameter, the number of threads and the shape of thread should be adopted, and we could then consider the question of adopting what this committee reports for the rest of the dimensions in the injector pipe couplings. I would therefore move that this matter be referred to the executive committee with the recommendation that they consider the advisability of placing this matter in the hands of the joint committee on Uniformity in Pipe Unions.

G. S. Goodwin, (C., R. I. & P.): I appreciate the point made by Mr. Young, but as I recall the matter, the union of the Master Mechanics' Association is something which has been standard for some little time. The report made by Mr. Haig's committee is only a year old, and the specifications of that committee with regard to the threads, size of threads, the number of threads per inch are, therefore, later than the standards of the Master Mechanics' Association unions as they stand now, and it seems to me that we ought to favor Mr. Haig's recommendation in that matter as being more up to date. I understand that the union will probably be a matter of investigation for a committee of this association at a later time.

W. E. Dunham, (C. & N. W.): Mr. Young's motion is simply to cover the thread as recommended by this committee, and not the flange connections and all these other details. As I recall the report of this committee last year, those details were so interlocked as between the flange connection and the screw connection that it will tie this matter up completely if any part of it is referred for further action. It seems to me that we could consistently refer this matter to letter ballot as recommended practice of the association.

Mr. Pratt: The purpose of making anything the recommended practice of the association instead of making it as a standard, is to allow for further experimentation on the part of the members. If it is conceded that the recommendation of the committee is much better than what we have in our present proceedings, that it might be well worthy of consideration whether we should not improve our proceedings and drawings, even though they be subsequently changed or further improved.

T. F. Barton, (D., L. & W.): The committee in looking into this matter had no knowledge about the matter of pipe couplings coming up. In the replies we got from 35 railroads, we found that 34 were using 10 threads, and 15 were using 10 threads exclusively on all parts of the injector. That explains in part why we recommend the 10 thread.

S. W. Mullinix, (C., R. I. & P.): We have a number of locomotives equipped in this way, and personally I am in favor of it, but if we must continue the nut connection I would rather have 8 threads per inch, and the nut so designed that it will not begin to stretch and strip the threads.

W. J. Tollerton, (C., R. I. & P.): Our road is using 10 threads per inch on these nuts.

T. F. Barton: The committee, in considering a coarser thread, took into consideration that the pipe connections were gradually increasing and getting larger in size, and that by going to the 10 thread that there was a chance of pulling a tighter joint with the 10 than the 8 thread.

Wm. Schlafge, (Erie): All our modern locomotives are equipped with 10 threads and we are not experiencing any unusual trouble. I am firmly of the opinion that this association should adopt a standard individual connection and concur in the recommendations of the committee.

R. B. Kendig, (N. Y. C.): I believe this matter is essentially a locomotive matter, and I do not see why it should be tied up with the Master Car Builders' Association and the American Society of Mechanical Engineers in adopting this standard.

M. J. Drury, (A., T. & S. F.): On the Santa Fe we are using the 10 thread as a standard.

W. H. Corbett, (Mich. Cent.): The standard of the Michigan Central is 10 threads, and we find that we have good results with that size.

G. W. Rink, (C. R. R. of N. J.): We have waited long enough for a standard. Eight threads per inch is a little too coarse for all of our work, and I believe that 10 threads per inch is just about right for all nuts which secure fittings to the injector. I do not believe we should wait until we have a report from the joint committee referred to, regarding pipe union threads, because I am quite sure the threads per inch will vary, depending on the size of the pipe, and in that way the conclusions of this committee will amount to practically nothing. It is a locomotive proposition and I think it should be submitted to letter ballot as recommended by the committee.

Thomas Marshall, (Lehigh Valley): Our standard is a 10 thread connection, and I believe that is the proper one for the association to adopt.

(Mr. Young's motion was lost.)

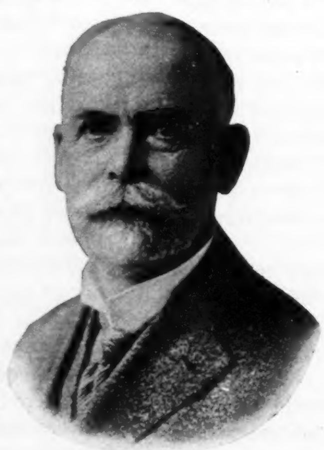
F. C. Pickard, (D., L. & W.): It seems to be the concensus of opinion that we adopt this standard, and the fact that the committee was appointed and has made a careful analysis of the subject should receive due weight by the members, I move that the report of the committee be accepted and be submitted to letter ballot.

(The motion was carried.)

Report on Standardization of Screw Threads

Frank O. Wells, the author of this paper, is admirably fitted to discuss the subject because of his long experience in the manufacture of taps and dies, and the important part he has played in the standardization of screw threads. Becoming interested in the industry at the age of 18, he has for the past 43 years studied, invented and manufactured screw-cutting tools and appliances. He is thoroughly conversant with every detail of their construction and their usage, and is a recognized authority on the subject. He is a member of the American Society of Mechanical Engineers and a member of a committee appointed by that association to standardize screw threads.

Mr. Wells was superintendent of the Wells Brothers Company for many years, later president and treasurer. When the consolidation of the Wells Brothers Company, Wiley & Russell Mfg. Company and A. J. Smart Mfg. Company was made in 1912, under name of Greenfield Tap and Die Corporation, he was made president of the new company, which operates three plants with nine hundred and fifty employees.



F. O. Wells

Mr. Wells shows the necessity for carefully working out the limits for the tolerance of screw threads, and emphasizes the fact that it is not the screw cutting tools that have to interchange but the work done by them. Screw threads, subject to vibration, must be neither too loose nor too tight.

In searching for the principal reasons of misfits in screw threads over a period of years, it has been found that non-interchangeability is not so much due to inaccuracy in the screw-cutting tools themselves as to the unreliable methods employed in taking and transferring measurements, and also to the total disregard of proper tolerances for both male and female threads. In theory, screw-cutting tools should reproduce their own threads; in practice they do not always on account of the conditions, all of which can be controlled. Therefore, the principal point to be brought forward at this time is the fact that it is not the tools that have to interchange, but the ***work done*** by them.

It is generally agreed among the tap-and-die and screw manufacturers that the screw is the base from which all formulas and calculations should be derived. The usual custom is to tap a hole and fit the screw to the tapped hole, and in the process of making a screw, if the lead of the tap, which has been used to tap the hole, is not normal, the operator keeps cutting down the screw to fit the hole, and consequently gets it greatly undersize before it fits. Therefore the operator does not get a proper bearing on the angle of the thread.

The U. S. S. form of thread, which is the standard in this country, has an included angle of 60 deg., with the top and

bottom flatted one-eighth of the pitch. By flatting the thread on the top and bottom, we increase the cross-sectional area of the bolt and also avoid a sharp fillet which is something that all good designers try to avoid. By having a flat top, dies, taps and gages have a longer life, because they have no sharp edges to crumble and wear away quickly.

There are no two manufacturers who use the same formula for obtaining the sizes V-form of thread. The V oversize was made so originally to get away from the sharp top and to make screws from ¼ to 2 in.; a 1-32 in. oversize is absurd. Iron used to be made oversize because the mills could not work to the close limits that they do to-day. The scientific U. S. S. thread is much better than the unscientific V-thread. In order to use the theoretical V standard, it is necessary to make the outside of the screw considerably undersize.

In order to properly standardize screws and taps, there

G.S.-280		TAPPED HOLE LIMITS FOR U.S.S. TAPS									Loose Fit Limits.	
Size	P	Basic or P.D. of Max. Sc.	Min. Sc. P.D. Proposed	Max. Sc. over Min. Sc.	Min Tap over Basic	Tapped Hole Pitch Diams. Min.	Tapped Hole Pitch Diams. Max.	Tapped Hole Diff.	Gage Pitch Diams. Min.	Gage Pitch Diams. Max.	Gage P.D. Diff.	Min. Gage over Max. Scr.
1/4	20	.2175	.2160	.0015	.0005	.2180	.2200	.0020	.21775	.22025	.0025	.00025
5/16	18	.2764	.2745	.0019	.0006	.2770	.2790	.0020	.21675	.27026	.0025	.00035
3/8	16	.3344	.3325	.0019	.0006	.3350	.3380	.0030	.33475	.33825	.0035	.00035
7/16	14	.3911	.38915	.00195	.0009	.3920	.3950	.0030	.39175	.39525	.0035	.00065
1/2	13	.4501	.4481	.0020	.0009	.4510	.4540	.0030	.45075	.45425	.0035	.00075
9/16	12	.5084	.5064	.0020	.0011	.5095	.5135	.0040	.50925	.51375	.0045	.00085
5/8	11	.5660	.5635	.0025	.0010	.5670	.5710	.0040	.56675	.57125	.0045	.00075
11/16	11	.6285	.6260	.0025	.0010	.6295	.6335	.0040	.62925	.63675	.0045	.00075
3/4	10	.6851	.6821	.0030	.0009	.6860	.6900	.0040	.68575	.60025	.0045	.00075
13/16	10	.7475	.7445	.0030	.0009	.7484	.7534	.0050	.74815	.75375	.0055	.00065
7/8	9	.8028	.7996	.0032	.0011	.8039	.8089	.0050	.80365	.80915	.0055	.00085
15/16	9	.8653	.8621	.0032	.0011	.8664	.8714	.0050	.86615	.87165	.0055	.00085
1"	8	.9188	.9155	.0033	.0012	.9200	.9250	.0050	.91975	.92525	.0055	.00095
1 1/8	7	1.0322	1.0280	.0042	.0013	1.0335	1.0385	.0050	1.03325	1.03875	.0055	.00105
1 1/4	7	1.1572	1.1530	.0042	.0013	1.1585	1.1635	.0050	1.15525	1.16375	.0055	.00105
1 3/8	6	1.2668	1.2625	.0043	.0012	1.2680	1.2740	.0050	1.26775	1.27425	.0065	.00085
1 1/2	6	1.3916	1.3875	.0043	.0012	1.3930	1.3990	.0060	1.39275	1.39925	.0065	.00085

Max. Tap

Min. Tap.

Max. Screw

Min. Screw.

Tolerance Between Min. Tap and Max. Screw.

Table of Tapped Hole Limits For U.S.S. Taps

GREENFIELD TAP & DIE CORP'N
GREENFIELD MASS U S A

Table of Tapped Hole Limits for U. S. S. Taps

must be tolerances which can be used both economically and commercially, and the table shown herewith is adaptable for railroad and other work which do not require the close limits. In discussing tolerances for screw threads, it is necessary that two vital facts be established at the outset. First, that the screw must be basic or smaller, and secondly, that the taps must be over basic. Fig. 1 shows a drawing illustrating the practical application of tolerances.

The diagram shows a ½-13 U. S. S. screw in a tapped hole. The outside diameter of the tapped hole is .502 in. and the outside diameter of the screw is .498 in. The tolerance is represented by the small trapezoid at *A*. The tap, after being used, would wear, and this wear would bring the pitch diameter down and so decrease the area of *A*, which would approach zero as a limit.

For the inspection of screws the fork limit gage is one of the most economical tools that can be employed on this work. With the "GO" points set to the maximum limits and the "NO GO" points to the minimum limits, an operator can measure a thousand ½-13 screws per hour. This is done by laying the screw on the gage and letting the weight of the screw do the rest. If it passes the first set of points, and not the second set, it is within the limits. For the inspection of tapped holes the double-end plug gage is the best. The short end is the "NO GO" and the long end the "GO." The "GO" end is made long so as to measure the lead as well as the pitch diameter.

It is a fact that the vast majority of taps break in use and that very few wear out. Some authorities put the total breakage at 90 per cent of all the taps used. This breakage is due largely to the fact that the holes which are to be tapped are not either drilled or reamed to a large enough size. For ordinary work three-quarter depth of thread is good practice. A nut having only one-half depth of thread will break the bolt before it will strip the threads.

The outside diameter has little or nothing to do with the fit of a screw thread as long as the screw is made basic, or smaller, and the tap over basic. If this condition exists, when put into use the metal in the top of such threads "flows" and makes a fit depending upon the tolerances; the closer the tolerances, the tighter the fit. Pitch diameter and lead are two factors of equal and reciprocal importance. To obtain true working standards, these factors must have close attention on the part of the designing engineer. It is well to note that in all threads that have walls which have an included angle of 60 deg. that an error (short or long) of .001 in. per inch in lead is equivalent to an error of .0018 in. pitch diameter when the length of fit is one inch. Therefore, it will be seen that the lead of screw threads should be given careful consideration, but it is a fact that it is a factor which has been woefully neglected.

It has been found, after a long series of tests, that long, curly chips from taps require less power, and there is consequently less breakage than from taps which make fine, granulated chips. This statement is equally true of dies. To obtain these curly chips it has been found necessary to give these taps and dies a certain amount of positive rake, this

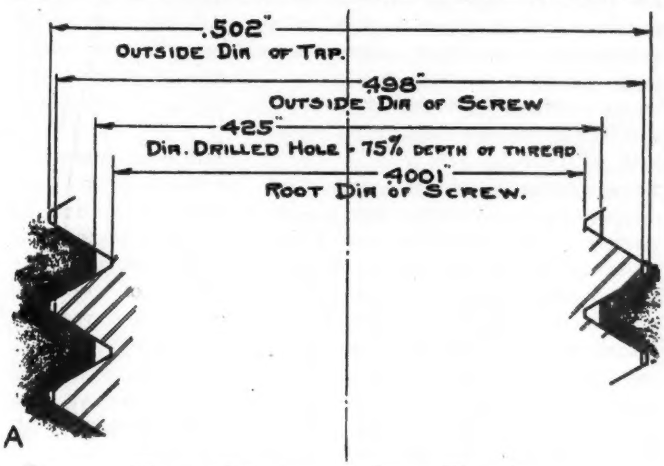


Fig. 1.—Tolerance of Screw Threads

rake depending upon the material to be cut. One would not think of using the same lathe tool or milling cutter for cutting all kinds of material, and the same condition exists with taps and dies.

To make the tolerance of screw threads within well-defined limits for railroad work will tend to prevent the nuts and screws from working loose and no doubt help to decrease the number of accidents that can be prevented by some forethought and care. These limits must be very carefully worked out, because on screw threads subject to jar, if the fit is too loose, the parts will quickly come apart, while if the fit is too tight, the strain set up by the tight fit, together with the jar, will soon carry the part beyond its breaking strength and so cause a rupture.

DISCUSSION

Mr. Wells: The object of this paper is to try to bring the manufacturers of taps and screws and the users closer together. The first taps which we made were produced in 1824, 92 years ago. The last few years has seen more advancement in the standardization of screw threads than has taken place in the 40 years previous. The American Society of Mechanical Engineers has been working several years to standardize screw threads and they are still at it. The hard part of it seems to get the user and the screw makers, especially, to realize the importance of standardization.

In the last few years the V-thread has been almost entirely

eliminated by all the best manufacturers. By the use of the U. S. Standard threads we get a standard, which can be used the country over, and they have all worked to the same standard nuts and bolts all over the United States, which will interchange and fit, but with the V-thread you cannot do that. I think the railroads should have closer limits than any they are working with. There is nothing like having a close fitting nut and that can be secured by having proper tools. There must be a little neutral ground between the largest screw and the smallest tap, or they will not work together.

Metallic Packing for Superheater Locomotives

No paper was presented on this subject, it being discussed generally.

C. H. Hogan, (N. Y. C.): You all know the trouble we had when superheating was first introduced with the metallic packing, particularly on piston rods. While the difficulty has been overcome to a great extent, there is yet room for improvement. The manufacturers have put forth every effort to give us a packing that will give us 100 per cent service. We at times kill a good set of packing by not properly maintaining it—lack of lubrication, guides out of line, small piston head, packing carrying the load, particularly when drifting, etc. On the New York Central road we have a number of cross-compound superheater locomotives, on which we have single packing, and on which we found it necessary to use what the manufacturers advise is 50 per cent copper and 50 per cent lead, but the majority of our engines have tandem packing, and on those engines we use packing rings of approximately 80 per cent lead and 20 per cent antimony, which is giving good service. In cases where the rings melt out, owing to the temperature, approximately 50 per cent copper and 50 per cent lead should be used.

G. S. Goodwin, (C., R. I. & P.): A number of years ago, when we first got our Mikado type of locomotives—superheaters, of course—we were packing them with the 80 and 20 packing. These engines went into service on a division of about 100 miles, and we were very much pleased with fine performance we got from the packing.

After these engines had been in service about a year, in rearranging our power, it became necessary to put them on the longer division, approximately 180 miles, where we had heavy trains, and on that division the engines were working up nearer to capacity. We found then that we were beginning to have trouble with the packing, and as a result we are putting in the so-called 50 and 50 mixture.

Our analysis of that trouble was that the engines, being worked continuously at high power and were making a greater mileage than on the other division, when a little blow would start, and because the engine had to continue in service, it would increase and eventually melted the packing out.

F. C. Pickard, (D., L. & W.): On the Delaware, Lackawanna & Western Railroad we have a rather difficult proposition, on account of high superheat. We have a class of engines in passenger service on 1.3 per cent. grades, superheating at 740 degs., and some records show at 760 degs., on which we have had a great deal of difficulty in keeping the packing in them. After a great number of experiments were conducted, we decided on the 50 per cent. lead and 50 per cent. copper, together with a swab that is free from any wick packing of any kind and working automatically. This has proved very satisfactory.

B. R. Moore, (D. & I. R.): We are using the 50 and 50 packing on the steam end and 20 and 80 on the cross-head end, but our divisions are short.

R. E. Smith, (A. C. L.): We found, on one of our divisions about 220 miles long, very considerable trouble on superheater engines using the 80 and 20 packing. We thought possibly it was due to the high superheat arising out of long sustained runs without stops. We changed to the 50 and 50 packing, with some improvement, but a further investigation of the matter developed the fact that by closer attention to the condition of the piston rods, and a closer correspondence in the diameter of the piston head and the cylinder, we were able to go back to the 80 and 20 packing without any serious trouble.

J. A. Anderson, (B. & O.): On the Baltimore & Ohio, the observations that I have noticed along the line of the road indicate that damage to the packing is done in the drifting. I have in different places noticed a fellow coming in drifting, and shortly after pulling out there would be a blow in the packing, and after he would go a short distance the blow would take up. On our road engine we did not use any swabbing at all, and we do not have any oil cups, and the packing receives its lubrication from the cylinder. Wherever we have cylinder packing trouble, on that trip we find that we are mighty apt to have packing trouble on the piston. I feel it is a matter more of inside lubrication.

C. E. Chambers, (C. of N. J.): We tried the packing with 80 per cent. lead on superheater engines, and got very poor service. We have used quite extensively the 50 and 50 packing, with very good results. We have also used the cast-iron packing with very good results, and are using it at the present time.

C. E. Parks, (Mich. Cent.): On the Michigan Central for single packing we use the 50 and 50, and on compound engines, with the degree of steam at temperature about 750 degs., with divisions of 110 miles, where it is practically level, which would necessarily mean the working steam at practically uniform cutoff, we have had very good results.

H. C. Manchester, (D., L. & W.): The superheating packing proposition is a matter as to which packing should be used for the service in which the engines are used. We have got a lot of service which has been taken care of very nicely with 80 and 20 packing. We have got another kind of service which is a heavy fast drag where the 50 and 50 is the only thing that will stand. You could not get one trip up the hill without outside lubrication on the piston.

Professor Randall: One point I do not think has been brought out here is, what is the character of lubrication? Possibly with good lubrication an 80 and 20 packing which would have a lower melting point than the 50 and 50 packing might stand all right. Is not the fact that the question of putting a higher point mixture in there made necessary by probably not so good lubrication?

G. W. Wildin, (N. Y., N. H. & H.): We have one engine equipped with what is known as an economy steam chest in which we are using the old type U. S. multi-angular packing. If you get saturated steam in the cylinder when you are shut off, break the vacuum, and with proper lubrication it is my opinion that your troubles with metallic packing and piston rods will vanish. When we first started superheater engines, we put on a drifting valve by which the jet of steam was introduced into the cylinder. We also used the five feed lubricator, with one pipe in each cylinder and one in each of the steam chests. The jet of steam from the drifting valve entering the cylinder, through a plug in the cylinder, makes a sort of ejector and takes all the emulsion in the pipe into the cylinder instantaneously. That being saturated steam it rather cools the walls of the cylinder, prevents a vacuum in the cylinder, prevents carbonization, holds the lubrication already in the cylinder and puts in an additional amount instantaneously. We have been running superheater engines about three years, and to my knowledge we have never scored a cylinder nor a steam chest bushing. In fact, our troubles with superheater steam, so far as my memory goes, is less than it is with saturated steam. We have some

pretty considerable runs at that. We have a 156 mile run from New Haven to Boston on our limited train, with one to four stops. I guess the schedule of this train would compare favorably with most of the high class trains in the country, but so far we have not developed any trouble with either cylinder packing or piston rod packing. We have excellent water, however. We are following the suggestions of the superheater company in preparing our superheater elements, the same as the rest of you are doing.

O. C. Wright, (Penna. Lines): We are using both mixtures; the 80 and 20 mixture, however, is considered our present standard. When we first went into the superheater engine, we experienced considerable trouble, which was traced back to the question of lubrication, rather than to the question of the quality of the metal. I would like to concur in what Mr. Wildin has just said in regard to drifting, which has been exactly in accordance with our experience. On divisions where a great deal of drifting is done, we have had trouble with proper lubrication, and resultant trouble with packing.

H. W. Coddington, (N. & W.): We started out with the 80 and 20 metal when we first got superheated engines, and used that until we were convinced that we could not handle the engines. We simply melted the 80 and 20 all to pieces, and now use 50 and 50 metal for our superheat exclusively.

Mr. Manchester: We admit the steam for drifting through the bypass valves. When you open the throttle and your bypass valve is closed, your drifting steam is shut off.

O. C. Cromwell, (B. & O.): We had to go to the 50 and 50 packing on superheated engines. We had a somewhat better performance, but it was not entirely satisfactory. Our cylinder packing was giving us trouble at the same time. We commenced to correct the cylinder packing troubles, and then the piston packing troubles began to disappear. That was through the use of the drifting valve in connection with the throttle valve; that is, the Chambers throttle valve. I think the piston rod packing bears a relation to the lubrication of the cylinder; as soon as you get your cylinder packing to working properly, then your piston rod packing will cease giving you trouble. We found on short runs you could get along with the 80 and 20, but when you came to the long, heavy drag, you have got to go to the 50 and 50 packing. In addition to that, look out for the lubrication of your cylinder at the same time. The two go together.

M. H. Haig, (A. T. & S. F.): The concensus of opinion seems to be largely in favor of the 50 and 50 metal. That has been the experience of the Sante Fe on simple locomotives, and the high pressure rods of compound locomotives, but on the valve stem packing on superheater locomotives, it has been found possible to get satisfactory results with the so-called white metal, or what has been commonly referred to here today as the 80 and 20 mixture. There is no doubt but that the matter of lubrication, as brought out by Prof. Randall and several members, is a very important factor, but in addition to that there is the matter of keeping up the crossheads, piston rods, rods, etc., so that the piston rod does not ride on the packing, and add thereby to the amount of friction.

R. P. Blake, (N. P.): Our experience with packing on superheater locomotives has extended over a period of about ten years. At that time we had one engine equipped with a Vaughn-Horsey type superheater, operating on a mountain division, where there was a great deal of steady pulling, and in returning, drifting down the grades. We were using a soft metal packing of about 80 and 20 mixture, and tests showed that we were getting a superheat of about 625 deg. The engine gave very little trouble with the rod packing, although we had some difficulty with the cylinder packing, which was found to be due to the method of handling the engine in drifting down the grades. Shortly afterwards the engine was transferred to a water grade division of 100 miles, with a continuously ascending grade of approximately .4 per cent ruling grade. At no point on this division could you shut off without the train coming to a standstill. Under those conditions the engine performed very satisfactorily with the soft metal. A few years afterwards we secured some similar engines with the Schmidt superheater, and a slightly higher degree of superheat, and these engines in the same service gave good results with the soft metal, in some cases; other engines caused incessant trouble from the time they started in, which led us to believe that it was partly due to the way the engines were handled. In some cases the method of handling the engine gave higher degrees of superheat, and the performance of the fireman affected that. We have adopted the 50 and 50 mixture for our superheater engines, and are getting excellent results with it, as long as the wearing parts of the crosshead, rods and heads are properly maintained, but if they are not kept up to where they should be, there is bound to be trouble, not only with the packing blowing, and losing the proper lubrication, but with the range breaking.

The President: We will consider the discussion closed.

Tests of Passenger Car Radiators

Pennsylvania State College has given much attention to railroad subjects in recent years, and this paper describes tests made at that institution.

Prof. Arthur J. Wood, the author, three years ago, after a careful study of the railroad requirements, organized and has since conducted the railroad mechanical courses at the Pennsylvania State College, to which has come many students who intend to follow railroad work. Prof. Wood was born in Newark, N. J., 1874. He was graduated in mechanical engineering from Stevens Institute of Technology, and was associate editor of the RAILROAD GAZETTE, *1896 to 1899. Most of the time since he has taught mechanical engineering at the Worcester Polytechnic Institute, Delaware College and the Pennsylvania State College, and has also acted as consulting engineer for a number of companies. He is a member of the American Society of Mechanical Engineers, and several other engineering and scientific associations. He was elected an associate member of the Master Mechanics' Association in 1914. He is the author of a text and reference book on Principles of Locomotive Operation and Train Control, published December, 1915, which contains the results of practical experience and studies of railroad problems. In February, 1916, the degree of Master of Science was conferred upon him, partly in recognition of published research work in railroad mechanical engineering.*

Prof. A. J. Wood

THE tests here set forth and made under the direction of the writer by Messrs. R R. Neely and F. W. Specht, graduates in mechanical engineering at the Pennsylvania State College, were conducted primarily to determine the relative efficiencies of four types of car radiators. The writer acknowledges the services of C. F. Kopp, instructor

in mechanical engineering, for reviewing the paper as here presented. The scope of the study was extended to a discussion (a) of the effect on the heat taken up by the air due to different steam pressures and air velocities; and (b) of a rational unit basis for rating different types of radiators.

These tests were intended to apply only to conditions approaching those of indirect radiation, in which air at the outside temperature enters the passenger car through a hood above the roof of the car and passes through a duct to the floor level and thence through a sheet-iron box which extends along the sides of the car. The quantity of air entering the car

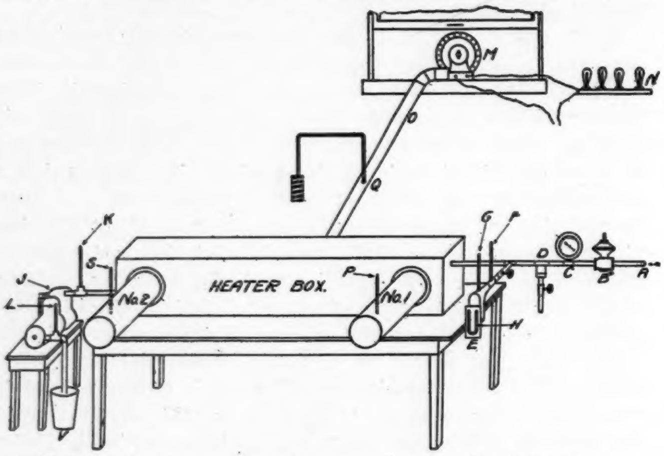


Fig. 1.—Arrangement of Apparatus for Radiator Tests

changes with the speed of the train. The air is warmed by passing over radiators placed in the heater box and it enters the car through cylindrical ducts, or guns, placed directly under each seat. These guns are about 8 in. in diameter and extend out from the sheet-iron heater a distance of 18 in. The heated air passes up through the car, escaping through the ventilators in the roof of the car.

3. Many types of radiators may be used in the system de-

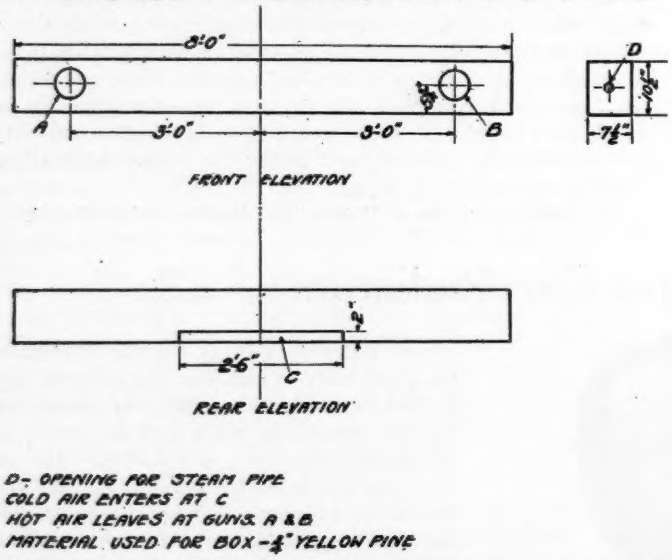


Fig. 2.—Dimensions of Heater Box Used in Radiator Tests

scribed above. In the long heater box (with a cross section of but 6 in. by 9 in.), only a certain amount of radiation may be used. The underlying problem is one of finding the most effective radiation for the space available, and a study of this leads directly to the question, What should be the basis for accurately comparing the efficiency of one type of radiator with another under the restrictions of the indirect system?

4. The sketch, Fig. 1, shows the arrangement of the apparatus used in these tests, and Fig. 2 gives the dimensions of the heater box. Steam at about 150 lb. pressure entered the ¾-in. pipe at *A*, Fig. 1, and passed through the reducing valve, *B*, the lower pressure being shown by the gage at *C*. A steam separator was placed in the line at *D*, and a throttling calorimeter at *E*. The temperature of the steam entering the calorimeter was read at *F*, and the thermometer at *G* gave the temperature of the steam in the calorimeter. The manometer tube, *H*, showed the pressure in the calorimeter in inches of water. The condensation from the radiator passed into the steam trap, *J*, the temperature of the combined steam and water from the radiator was shown by the

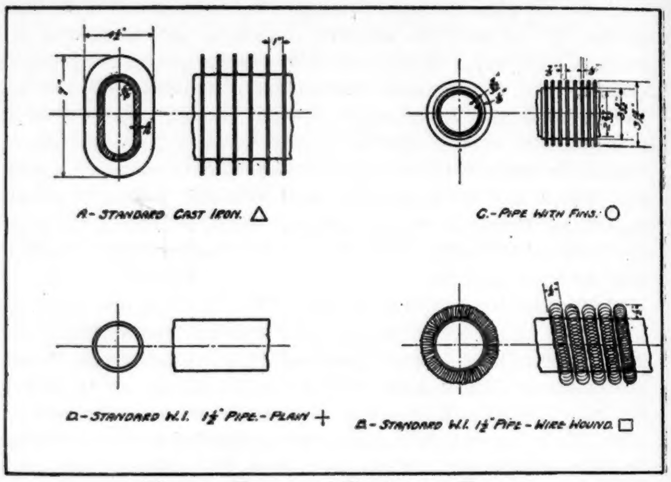
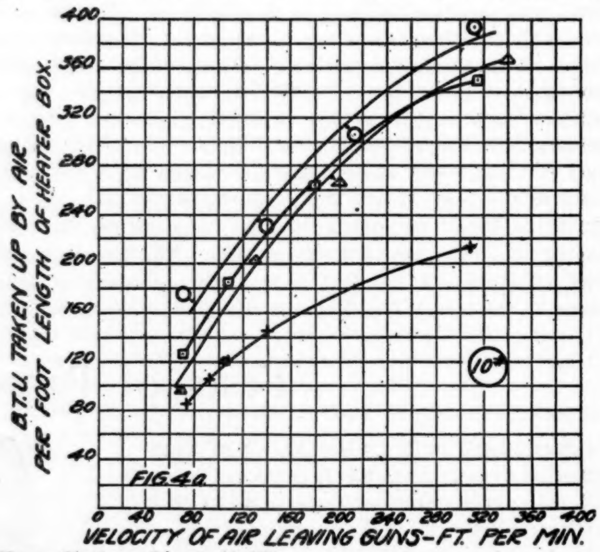


Fig. 3.—Types of Radiators Tested

thermometer at *K*, and the temperature of the condensed steam leaving the trap, by the thermometer at *L*. The condensation was collected in the pail, *V*, and weighed at the end of each hour run.

At *M* is shown the small Sirocco fan installed for drawing in the cold air. The room was at nearly a constant tem-



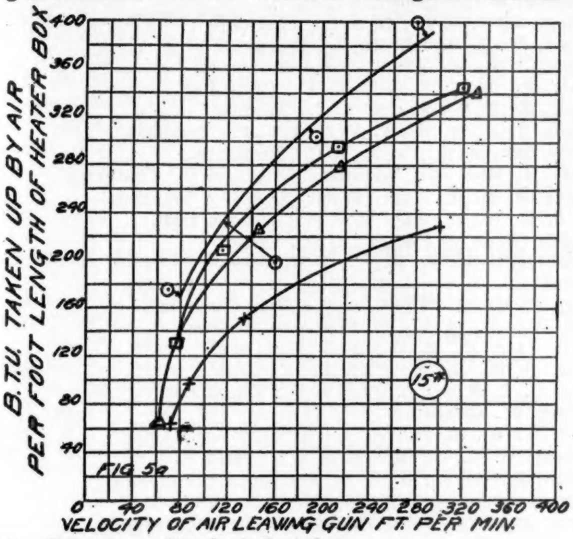
KEY.—Circle = Pipe with Fins.
Square = Wire Wound.
Triangle = Standard Cast Iron.
Cross = Plain Pipe.

Fig. 4.—Effect of Air Velocity on Heat Taken up by Air at 10 lb. Steam Pressure

perature during a test. The fan was driven by a small direct-connected shunt-wound motor, the speed of which was regulated by a lamp board resistance, *N*. Leaving the fan, the cold air passed through the pipe, *O*, and entered the heater box, *I*. The air passed around the radiator and escaped by the guns, which were 5½ in. in diameter and 18 in. long, and are designated as No. 1 and No. 2. The velocity of air leaving these guns was obtained by means of an anemometer. The temperature of the heated air leaving the box was measured by thermometers, *P* and *S*, placed in the guns. A Pitot tube at *Q* gave the total and the static pressure of the air in the pipe entering the box.

Attention may be called to the fact that the conditions under which the tests were conducted were not alike in all respects to the conditions in car service. A close study of the report will bring out the fact that the results are to be used only for comparing one type with another, and this should be kept in mind in reviewing the tests.

General Method of Testing.—As noted, cold air was blown over the radiator in the box, the fan being placed in the window of the room where it drew in cold air, the test being conducted in winter weather. The temperature of air was taken as it entered and as it left the heater box, the quantity of air being determined from the velocities through the intake. The

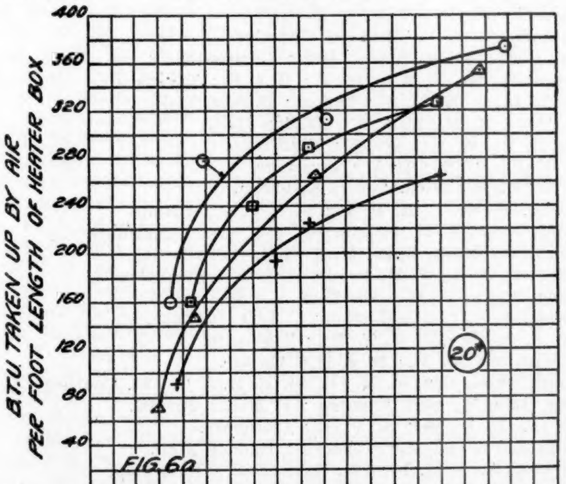


KEY.—Triangle = Standard Cast Iron.
Square = Wire Wound.
Circle = Pipe with Fins.
Cross = Plain Pipe.

Fig. 5.—Effect of Air Velocity on Heat Taken up by Air at 15 lb. Steam Pressure

quality of steam entering the radiator was found in connection with determining the total heat supplied to the radiator.

Steam was supplied to the radiators at 10, 15, 20 and 25 lb. pressure, and for each of these pressures air was blown over



KEY.—Triangle = Standard Cast Iron.
Square = Wire Wound.
Circle = Pipe with Fins.
Cross = Plain Pipe.

Fig. 6.—Effect of Air Velocity on Heat Taken up by Air at 20 lb. Steam Pressure

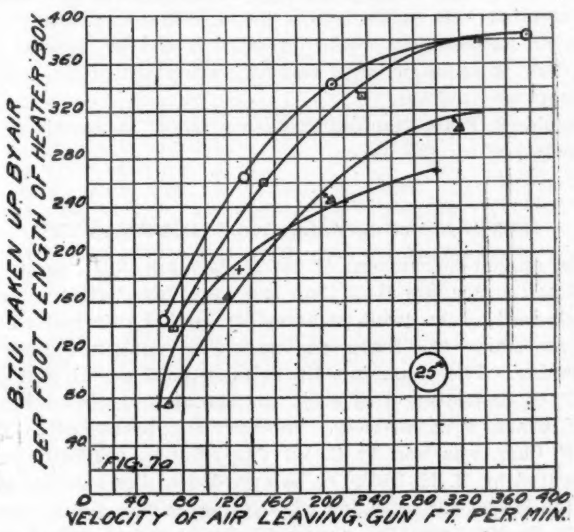
the radiators at four different velocities, as determined by four fan speeds, thus making a total of sixteen tests for each radiator.

Description of Radiators.—The four types of radiators tested have been given, somewhat arbitrarily, the following names: (A) Standard Cast Iron (S. C. I.), (B) Wire Wound, (C) Pipe with Fins, and (D) Plain Pipe. These are shown in Fig. 3. The Wire Wound radiator was made up of two 8-ft. lengths of pipe, connected in the same manner as the plain pipe radiator. On each 8-ft. length of pipe was about 7½ sq. ft. of coiled or wrapped wire of special composition metal resembling machine shop turnings. The wire coils break up the air current about the pipe and also give a larger radiating surface. Pipe with Fins type of radiator (of which a single length of pipe was used) consisted of a plain 2½-in. pipe, on which was shrunk round forgings 1 in. apart. The Plain Pipe radiator was made up of two 8-ft. lengths of 1½-in. pipe. Note that in the Pipe with Fins there is a close contact between the washer and the pipe, whereas in the Wire Wound a relatively poor contact is made between the pipe and the wire.

The weights, calculated square feet of surface and length of section of radiators used, are given in the following table:

	S. C. I.	Wire Wound.	Pipe with Fins.	Plain Pipe.
Weight in heater box, lb.......	135	51.5	103	30.81
Total single length in box, ft...	6.33	8.0	8.0	8.0
Total actual exposed metal surface in heater box, sq. ft.....	20	27.48	19.15	6.68

The surface of the Wire Wound radiator was calculated as the total surface of the wire plus the surface of the pipe. In calculations involving the length of radiators, the actual length



KEY.—Triangle = Standard Cast Iron.
Square = Wire Wound.
Circle = Pipe with Fins.
Cross = Plain Pipe.

Fig. 7.—Effect of Air Velocity on Heat Taken up by Air at 25 lb. Steam Pressure

tested was used. For Wire Wound and Plain Pipe, the length tested was 16 ft.

Results.—The following is a comparison of the relative values of the different types of radiators tested on a basis of the heat taken up by the air per equal weight of steam condensed:

		Type of Radiator.		
On a basis of:	S. C. I.	Wire.	Fins.	Plain Pipe.
Equal radiator surface ..	37	23	34	100
Equal radiator weight ...	26	72	31	100
Equal radiator lengths ...	100	40	69	35

Compared on a basis of the heat taken up by the air per maximum possible weight of the steam condensed in the tests the following rating is obtained:

		Type of Radiator.		
On a basis of:	S. C. I.	Wire.	Fins.	Plain Pipe.
Equal radiator surface ...	69	37	56	100
Equal radiator weight ...	47	91	48	100
Equal radiator length ...	100	29	61	10
Equal heater box length..	100	73	78	43

The results of determinations for all radiators for the four fan speeds plotted in terms of B. t. u. taken up by the air per foot length of heater box* are shown in Figs. 4, 5, 6 and 7.

*In Figs. 4, 5, 6 and 7 the comparisons are based on the total heat taken up by the air under the assumption that the heater box contains the maximum number of radiator lines possible with each type of radiator tested.

Note that the general tendency of the curves to bend toward a horizontal line indicates that a maximum velocity of air is reached, beyond which the rate of heat transfer becomes more nearly uniform. In other words, the curves (regardless of type of radiator) approach a critical point, beyond which any increase in air velocity is not followed by a corresponding increase in the heat taken up by the air.

The writer would note that a similar result was reached in the case of tests on insulated steel postal cars at velocities up to 1,000 ft. per min. In these tests the air was blown parallel to the surface over the outside of a steel sheet of a section 5 ft. by 5 ft. cut from a car and forming the sixth side of a cubical corkboard testing box. The two important results brought out by the tests on car sections are (1) the notable increase in the unit transmission for velocities up to 1000 ft. per min. and (2) the almost constant value for the unit transmission for velocities from 1000 to 1600 ft. per min.

The president, in introducing Professor Wood, said that he was an associate member of the Association, but was not a member of the Master Car Builders' Association, and he had some data and information which seemed too valuable not to have general distribution. Therefore, this paper was presented to this Association and at the Executive Committee meeting last night, it was decided that the Master Mechanics' Association would present it to the Master Car Builders' Association with the suggestion that they print it in their proceedings.

President Pratt thanked Professor Wood, on behalf of the Association, for the paper.

ANNUAL McBARMMA GOLF TOURNAMENT

The annual tournament of the McBarmma Golf League was held at the Seaview Golf Club last Saturday, but for reasons which need not be dwelt on here—for further information, ask the secretary—the *Daily* was unable to publish the results yesterday. The championship prize, a gold medal, was won by T. C. de Rosset, with a 90, and the club championship by F. H. Clark, with 103-14-89. The Carr cup, presented by Robert F. Carr, was won by E. W. Van Houten; the Gillis prize, presented by H. H. Gillis, to be awarded to the member making the lowest net score and who had never won a prize before, by D. R. MacBain; the approaching and putting contest, by H. F Ball, and the Sargent luck cup, given by G. H. Sargent, went to H. H. Vaughan.

MORNING PLAY

	Gross	Hdk.	Net		Gross	Hdk.	Net
T. C. de Rosset...	90	0	90	M. K. Barnum....	109	14	95
W. L. Connell....	103	2	101	G .H. Sargent....	111	18	93
H. A. Gillis......	97	2	95	D. R. MacBain...	114	18	96
E. W. Van Houten	100	4	96	R. B. Kendig.....	128	24	104
H. H. Vaughan...	97	6	91	F. V. Green......	127	30	97
C. F. Quincy.....	101	10	90	B. P. Flory......	121	24	97
R. F. Carr.......	111	10	101	J. C. Chidley.....	115	18	97
F. H. Clark......	103	14	89	N. M. Garland....	106	4	102
C. F. Street......	107	12	95	S. P. Bush.......	103	0	103
H. F. Ball.......	107	14	93				

AFTERNOON PLAY—CLASS A

	Gross	Hdk.	Net		Gross	Hdk.	Net
T. C. de Rosset...	99	0	99	J. L. Replogle....	112	10	102
W. L. Connell....	100	2	98	C. F. Quincy.....	93	10	83
A. A. Gillis......	99	2	97	S. L. Kneass.....	108	10	98
E. W. Van Houten	95	4	91	R. F. Carr.......	100	10	90
E. O. Warner.....	99	4	95				

Class A first prize won by C. F. Quincy. Second prize, R. F. Carr.

AFTERNOON PLAY—CLASS B

	Gross	Hdk.	Net		Gross	Hdk.	Net
F. V. Green......	114	30	84	W. O. Wood......	112	14	98
R. B. Kendig.....	118	24	94	H. F. Ball.......	106	14	92
W. D. Robb......	124	24	100	F. H. Clark......	105	14	91
D. R. MacBain...	111	18	93	W. C. Arp.......	108	14	94
G. H. Sargent....	121	18	103	C. F. Street......	106	12	94
J. McNaughten...	122	18	104	J. Chidley........	122	18	104
M. K. Barnum....	108	14	94	B. P. Flory......	112	24	88

Class B first prize won by F. V. Green. Second prize, B. P. Flory.

ADDITIONAL MASTER MECHANICS' REGISTRATION

Anderson, J. A., M. M.; B. & O.; Strand.
Andrews, C. H., M. M.; Penna.; Traymore.
Arden, D. D., M. M.; Sardis & Delta; Baltimore.
Baker, Geo. H.; Dennis.
Ball, H. F., Economy Devices Corp.; Traymore.
Barnhill, C. F., M. M.; G. C. & S. F.; Chalfonte.
Bell, R. E., D. M. M.; G. C. & S. F.; Chalfonte.
Bennett, W. H., M. M.; Penna.; Traymore.
Bickford, S. A., M. M.; N. Y. C.; Lexington.
Bilty, C. H., Mech. Eng.; C. M. & St. P.; Traymore.
Boyden, N. N., M. M.; So. Ry.; Shelburne.
Bradley, W. H., M. M.; C. & N. W.; Chalfonte.
Brange, P. H.; Traymore.
Brennan, E. J., S. S.; B. & O.; Chalfonte.
Callison, W. A., M. M.; L. V.; Traymore.
Canfield, J. B., M. M.; B. & A.; Pennhurst.
Canniff, P., S. S.; F. E. C. R. R.; Craig Hall.
Carroll, W. P., M. M.; N. Y. C.; Dennis.
Cassady, J. A., M. M.; C. N. O. & T. P.; Traymore.
Chidley, Jas., A. M. P.; N. Y. C.; Traymore.
Clewer, H., Eng. Fuel Economy; C. R. I. & P.; Chalfonte.
Coddington, H. W., Engr. Tests; N. & W.; Traymore.
Cox, R. G., M. M.; Sav. & N. W.; Haddon Hall.
Crandall, W. J., M. M.; N. Y. C.; Dennis.
Crownover, G. M., M. M.; C. G. W.; Dennis.
Cunningham, J. L., M. M.; P. B. & W.; Chalfonte.
Daley, W. W., M. M.; N. Y. O. & W.; Chalfonte.
Davis, Wm. P., M. M.; N. Y. C.; St. Charles.
Deaner, Chas. F., M. M.; N. Y. C.; Dennis.
Deeter, D. H., M. M.; P. & R.; Jackson.
Drury, M. J., S. S.; A. T. & S. F.; Traymore.
Emerson, H., Blenheim.
Foster, W. H., M. M.; N. Y. C.; Chalfonte.
Gallaway, A. K., M. M.; B. & O.; Dennis.
Gardner, Clinton G., G. F. M. P.; Penna.; Blenheim.
Gardner, Henry, Ass't Engr.; B. & O.; Craig Hall.
Gaston, Jas. H., M. M.; Georgia R. R.; Traymore.
Gibbs, J. W., M. M.; V. & S. W.; Lexington.
Gillespie, W., Mech. Supt.; Cent. Vt.; Alamac.
Gillis, H. A., Seaside.
Goodwin, Geo. S., M. M.; C. R. I. & P.; Chalfonte.
Gray, B. H., S. M. P.; N. O. M. & C.; Traymore.
Gross, Edward G., M. M.; C. of Ga.; Sterling.
Hais, John, Spcl. M. P. Insp.; B. & O.; Dennis.
Harris, C. M., M. M.; Wash. Term.; Traymore.
Hartman, O. G., M. M.; Wis. & Mich.; Blenheim.
Hildreth, H. H., Mech. Engr.; Vandalia; Dennis.
Hill, W. H., M. M.; Cornwall R. R.; Lexington.
Hines, J. P., M. M.; B. & O.; Terminal.
Irvin, I. B., G. F.; P. S. & N.; Terminal.
James, Chas., Mech. Supt.; Erie; Chalfonte.
Johnston, H. W., S. M. & H. T.; B. & O.; Traymore.
Jones, L. B., A. E. M. P.; Penna.; Haddon Hall.
Kelly, O. J., M. M.; B. & O.; Haddon Hall.
Kight, H. R., M. M.; W. M.; Monticello.
Laux, J. P., M. M.; L. V.; Traymore.
Link, A., M. M.; Mich. Cent.; Blenheim.
McGowan, G. W., C. R. H. F.; H. & T. C.; Dennis.
McNulty, F. M., S. M. P. & R. S.; Mon. Con.; Chalfonte.
McRae, J. A., Mech. Eng.; M. & St. L.; Chalfonte.
Manchester, H. C., S. M. P.; D. L. & W.; Blenheim.
Mannion, T. D., M. M.; Atl. City.
Marricott, F. I., Ch. Draftsman; C. & O.; Alamac.
Maver, A. A., M. M.; G. T. Ry.; Traymore.
Malthaner, W., M. M.; D. & H.; Alamac.
Marshall, Thos., Gen. M. M.; C. St. P. M. & O.; St. Charles.
Mauger, John T., Gen. Foreman; P. & R.; Speidel.
Meade, P. J., M. M.; A. C. L.; Chalfonte.
Mechling, J. E., M. M.; Vandalia; Haddon Hall.
Miller, Geo. A., S. M. P.; Fla. East Coast; Craig Hall.
Miller, J. B., G. F.; St. L. So.; Somerset.
Miller, T. E., M. M.; B. & O.; Dennis.
Minick, J. L., Foreman; Penna.; Dennis.
Moll, George, M. M.; P. & R.; Sterling.
Morehead, L. B., Mech. Inspector; L. V.; Traymore.
Newman, C. M., S. S.; B. & O. S. W.; Dennis.
Perkinson, F. F., M. M.; B. & O.; Dennis.
Pichard, F. C., M. M.; D. L. & W.; Blenheim.
Querian, C. H., Supt. Elect. Equip.; N. Y. C.; Blenheim.
Rae, Clark H., Genl. M. M.; L. & N.; Dennis.
Ralston, J. A., Mech. Eng.; Union R. R.; Blenheim.
Randolph, Prof. L. S., Dean Eng. Dept. Va. Poly Inst; Seaside
Reid, W. L., Gen. Wks. Manager; American Loco Co.; Blenheim.
Rhodes, L B, Chalfonte
Rhuark, F. W., M. M.; B. & O.; Strand.
Robb, J. M., Blenheim.

Rusch, Frank, Genl. M. M.; C. M. & St. P.; Schlitz.
Rusling, W. J., A. E. M. P.; P. B. & W.; Brighton
Seeger, J. C., Shop Supt.; L. V.
Shackford, Ch. Draftsman; D. L. & W.; Blenheim.
Shelby, C. K., M. M.; Penna.; Chelsea.
Shepard, L. A., McCord & Co.; Brighton.
Smith, C. B., Mech. Eng.; B. & M.; Dennis.
Smith, D. A., D. M. M.; B. & M.; Strand.
Smith, E. J., M. M.; A. C. L.; Sterling.
Snell, E. J., M. M; N Y. C; Pennhurst.
Snyder, W. H., M. M.; N. Y. S. & W.; Alamac.
Staley, H. F., S. M. P.; B. C. G. & A.; Blenheim.
Warthen, H. J., M. M.; Wash. So.; Arlington.
Watters, J. H., Blenheim.
Webster, H. D., Mech. Eng.; D. & L. E.; Haddon Hall.
Wiggin, C. H., S. M. P.; B. & M.; Traymore.
Wooodridge, H. C., Spec. Repr.; B. R. & P.; Arlington.
Woods, J. E., G. F.; B. & O.; Traymore.
Stewart, A. F., M. M.; C. & O.; Traymore.
Sweetman, E. M., M. M.; So. Ry.; Traymore.
Turner, Amos, M. M.; L. V.; Deweld.
Turner, J. S., Blenheim.
Wanamaker, H., S. S.; N. Y. C.; Traymore.
VanDoren, G. L., Shop Supt.; C. of N. J.; Worthington.

ADDITIONAL MASTER CAR BUILDERS' REGISTRATION

Cunningham, J. L., M. M.; P. B. & W.; Chalfonte.
Drury, M. J., S. S.; A. T. & S. F.; Traymore.
Goodwin, Geo. S., Mech. Engr.; C. R. I. P.; Chalfonte.
Hessenbruch, T. E., Gen. Insp.; P. & R.; Haddon Hall.
Knox, W. J., Mech. Eng.; B. R. & P.; Brighton.
McRae, J. A., M. E.; M. & St. L.; Chalfonte.
Malthaner, W., M. M.; D. & H.; Alamac.
Wiggin, C. H., S. M. P.; B. & M.; Traymore.

ADDITIONAL SPECIAL GUESTS

Adams, C. S., Ass't Gen. Fore.; N. Y.; Pennhurst.
Aitken, Frank, M. M.; P. M.
Alexander, Geo., Retired Eng.; P. & R.; Emmet.
Baker, J. B., Supvr. Off. of Gen. Mgr.; Penna.; Shelburne.
Barnum, E. S., M. P. Insp.; P. L. W.; Dennis.
Bebout, G. W., Elect. & Shop Engr.; C. & O.; Chalfonte.
Bennett, R. G., Ass't M. M.; Cumb. Val.; Haddon Hall.
Blake, F. H., M. P. Insp.; Penna.; Craig Hall.
Bleasdale, Jas., M. M.; B. & O.; St. Charles.
Bleasdale, J. L., B. & O.; St. Charles.
Boring, Richard N., Penna.; Craig Hall.
Bosworth, W. M., Mech. Eng.; Nor. So.
Brancher, P. S., Fd. Manager; P. & R.; Traymore.
Briggs, J. H., P. & R.
Brown, C. C., Genl. P. Wk. Insp.; B. & O.; Alamac.
Brown, Chas. G., Special Appr.; Penna.; Arlington.
Brown, F. S., Mech. Eng.; Erie; Deville.
Brown, Thomas, Erect. Shop Fore.; P. & R.; Steveson.
Burkhard, A. A., Ass't Gen. Fore. Car Dept.; N. Y. C.; Arlington.
Burr, H. S., Supt. of Stores; Erie; Dennis.
Callan, F. A., Eng.; L. V.; Craig Hall.
Campbell, J., Supt.; L. V.; Pennhurst.
Canfield, J. B., Jr., B. & A.; Pennhurst.
Carter, G. H., Fore. Rd. House; P. & R.; Norwood.
Carty, F. J., M. E.; B. & A.; Alamac.
Cathcart, H. W., Fuel & Loco. Insp.; P. & R.; Jackson.
Chaffee, W. D., M. M.; N. Y. C.; Dennis.
Childers, C. B., C. N. O. & T. P.; Traymore.
Clements, S. L., Fore. Pass. Eq.; C. of N. J.
Coates, H. T., Jr., Asst. Eng. M. P.; Penna.; Craig Hall.
Cooke, D. E., Genl. Foreman, N. Y., N. H. & H.; Arlington.
Copeland, T T., R. F. of Engs.; Union R. R.; Waldorf.
Corkill, L. M., Foreman; C. of N. J.; Lyric.
Dampman, W. M., Foreman Eng.; P. & R.; New Clarion.
Davids, C. N., Pur. Agt.; Colo. Mid.
Davidson, Capt. W. G., Pur. Agt.; C. V.; Chalfonte.
Desmond, Jas., R. Fore. Eng.; D. & H.; Chelsea.
Dobson, J. D., Secy. to G. S. M. P.; B. & O.; Bouvier.
Dodds, T. D., Sec. to S. M. P.; B. & O.; Alamac.
Dugan, Garfield A., Fore. Eng. House; P. & R.
Dyre, W. E., Chf. Clerk; L. E. F. & C.; Galen Hall.
Eltringham, John H., Engineman; P. & R.; Ramsey House.
Faust, Frederick J., Insp. M. P. & R. E. Dept.; P. & R.
Fleming, H. D., Gen. Foreman; B. & O.
Flynn, H. A., Sup. Air Brakes; D. & H.; Arlington.
Fuller, D., M. M.; So. Ry.; Traymore.
Garber, F. M., Gen. Car Fore.; B. & O.; Elberon.
Gibson, J. A. B., Mech. Engr.; R. F. & P.; Arlington.
Gorrell, M. B., Speed Record. Insp.; B. & O.; Arlington.
Graham, G. S., M. M.; D. & H.; Chelsea.
Graham, R. E., Wash. So. Ry.; Arlington.
Greig,, A. N., Asst. Boiler Fore.; C. & O.; Elberon.
Griffin, J. F., Gen. Fore. Car Dept.; N. Y. C.; Arlington.
Hahan, George E., Fore. Boilermkr.; P. & R.
Hawksworth, W. H., M. P. Inspr.; Penna.
Hayes, H. B., M. M.; A. G. S.; Sterling.
Herr, E. D., Apprent.; W. J. & S.
Hines, E. F., Eng.; B. & O.; Terminal.
Hoenig, J. A., Chf. Draftsman; N. Y. C.; Arlington.
Hosack, W. K., Genl. Fore.; West. M.; Monticello.
Howley, T. F., Supt. Loco. Operation; Erie; Strand.
Hunt, R. B., Mech. Eng.; F. E. C.; Craig Hall.
James, W. S., Erie; Chalfonte.
Jenkins, E. M., Ch. Draftsman; S. A. L.; Haddon Hall.
Kelleher, W. P., N. O. & N. E.; Traymore.
Keller, J., Gen. Fuel Insp.; L. V.; Dennis.
Kinney, Wm. A., Foreman Boilermaker; P. & R.
Kleine, Herbert J., Ch. Car Insp.; Penna.; Dennis.
Knox, W. J., Mech. Eng.; B. R. & P.; Brighton.
Lawrence, R. Z., Engr.; N. Y. N. H. & H.; St. Charles.
Link, P. J.; Mich. Cent.; Blenheim.
Linthicum, F., Asst. Rd. Fore. of Eng.; Penna.; Ten Byck.
Loughery, M. C., Retired Pass. Eng.; P. & R.; Edgewater.
Lyons, Martin J., Loco. Insp.; Penna.; Albemarle.
McLaughlin, M. P.; Strand.
McMenamin, Charles Geo., Ass't Fore. Eng. House; Penna.; Chester.
McNulty, R. M., Monongahela Conn.; Chalfonte.
Martin, H. B., P. A.; Coal & Coke; Monticello.
Mater, E. J., Inspr.; P. & R.
Merritt, P. F., C. C. to P. A.; P. L. W.; Brighton.
Miller, Geo. A., Jr., S. M. P.; F. E. C.; Craig Hall.
Milliken, S. J., P. B. & W.; Brighton.
Moll, John B., Insp. Engineman; P. & R.; Speidel.
Moll, R. H., P. & R.; Sterling.
Morgans, Frank, Eng.; P. & R.
Oakes, C. E., Mech. Eng.; K. C. So.; Craig Hall.
Paullis, Frank, Ass't to Supt. Shops; B. & O.; Dunlop.
Pearce, C. B., Ass't Rd. H. Fore.; W. J. & S.
Phetteplace, L. H., Genl. Manager; C. C. & O.; Haddon Hall.
Prest, Jabez, D. & H.; Elberon.
Purdue, W. M., Engineer; So. Ry.
Quinn, C. C., Fore.; L. V.; Pennhurst.
Rankin, C. W., R. H. Foreman; L. & N.; Chalfonte.
Rankin, John E., Engineer; Penna; Chalfonte.
Reardon, F. C., Supt. of Stoves; D. & H.; Chelsea.
Reichel, Geo. F., Fuel Supervisor; N. Y. N. H. & H.; Arlington.
Reiser, H. C., Pur. Agt.; N. O. M. & C.; Traymore.
Rives, E. A., Mach. Foreman; So. Ry.
Rives, E. A., Jr., Mach. Foreman; So. Ry.
Roheback, M. P., Foreman; Penna.; Lockhart.
Russell, H. B., Gen. Fore. Eng. Houses; P. & R.; Worthington.
Russell, Walter L., Gen. Fore. M. P. & R. E. Dept.; Atlantic Ry.; Speidel.
Sample, W. H., M. M.; Grand Trunk; Traymore.
Sandhas, H., Air Br. Insp.; C. of N. J.; Terminal.
Saylor, J. M., Foreman; P. & R.; Worthington.
Schum, H. S., Gen. Fore.; Penna.; Lockhart.
Scheifele, John, Rd. Fore. Engs.; P. & R.; Norway.
Shackford, J. W., Ch. Draftsman; D. L. & W.; Blenheim.
Sheldon, R. D., R. House Fore.; P. B. & W.
Slutzker, J., Asst. M. M.; Penna.; Traymore.
Snyder, F. M., M. M.; Penna.; Alamac.
Starritt, W. A., Pur. Agt.; C. C. & O.; Grand Atlantic.
Stull, H. W., Fore. Mach. Shop; P. & R.
Sullivan, M. W., Train Master; D. & H.; Arlington.
Tapman, W. H., Insp. Test Dept.; B. & O.
Temple, J. S., Ass't to Supt. Shops; B. & O.; Haddon Hall.
Thomas, F. W., Supt. of Apprent.; A. T. & S. Fe.; Traymore.
Thomas, J. H., Ass't Genl. Foreman; Penna.; Brighton.
Thompson, F. V., Electr. M. P. Dept.; Atlantic City R. R.
Tignon, T. P., M. M.; N. & W.; Blenheim.
Tubbs, H. K., Ch. Clerk; Penna.; Pennhurst.
Turner, W. R., Fore. E. House; P. & R.; Van Belle.
Tracey, Bernard C., Sup. Elec. Welding; B. & O.; Seaside.
Wagner, William F., Fore. Eng. House; P. & R.; Van Belle.
Walther, A. C., Asst. Sup. Piece Wk.; B. & O.; Dennis.
Wambaugh, R. H., Spec. Insp.; B. & O.; Craig Hall.
Warthen, J. J., Jr., Washington So. Ry.; Arlington.
Webb, M. L.; Sec. to S. M. P.; B. & O.; Bouvier.
Welch, E. F., Foreman; Panama, Dennis.
Welch, J. L., Panama R. R.; Dennis.
Wightman, F. A., M. P. Inspr.; Penna.; Strand.
Williams, M. E., Foreman; P. & R.
Wilson, J. M., Fore. Eng. House; P. & R.; Miller Cottage.

Wilson, W. E., Monticello.
Woods, J. L., Pur. Agent; N. C. & St. L.; Traymore.
Wood, W. H., Supt. Power Plants; B. & O.; Haddon Hall.
Yeager, J. R., Genl. Foreman; West. Md.; Monticello.
Yeakle, Elmer C., Eng.; P. & R.
Young, W. D., Asst. Train Mast.; Penna.; Elberon.

THE M. M. INFORMAL DANCE

There were 12 dances on the card for last night's M. M. Informal Dance or reception on the Million Dollar Pier. In spite of the weather conditions there was a large attendance. the dancers cared not whether it rained or the moon was shining outside. The center of attractions was the ball-room floor.

The committee in charge consisted of Mr. Krepps, general chairman, assisted by Mr. Clements, chairman, and Messrs. Denyran, Hungerford, Bancroft, Coffin, Schumaker, Roe and Sawyer.

LITTLE INTERVIEWS

"The Louisville & Nashville is doing a large business and we in the mechanical department are particularly busy," said C. F. Giles, superintendent machinery of the L. & N. and a member of both associations, Tuesday, on his arrival at Atlantic City from Louisville. Mr. Giles is a member of the executive committee of the M. M. Association and is also a member of the committee on "Best Designs and Materails for Pistons, Valves, Rings and Bushings."

"The L. & N. builds its own locomotives," added Mr. Giles, "and orders are now out for the material for eight locomotives to be built in our shops. Four of them will be 8-wheel switchers and four Mikados. Orders are also out for material for 1,600 freight cars of various types to meet the demands of the heavy business we are now enjoying." Mr. and Mrs. Giles are stopping at Chalfonte, and this year Miss Margaret Giles, their daughter, is with them.

HORATIO N. SPRAGUE, CHARTER MEMBER

Horatio N. Sprague, the last living charter member of the Master Mechanics' Association, died June 6th at the home of his daughter-in-law, Mrs. Ella Sprague, Millvale, Pa.

Mr. Sprague has planned to attend the convention this year. Learning of this the *Daily* wrote to him suggesting the advisability of publishing a little story of the early days of the association. To this request Mr. Sprague sent the following letter, written the day before he passed away.

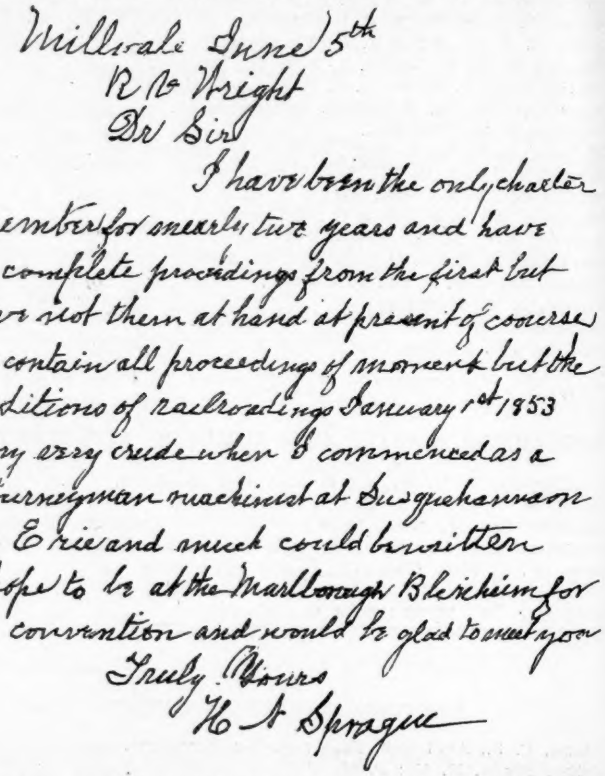
Mr. Sprague had prepared the following sketch of his life-work, intending to bring it to the convention with him.

"I was born in the town of Laona, Chautauqua County, New York, February 27, 1834, spending my boyhood days in Dansville and Rochester, N. Y.

"After a short apprenticeship at Geneseo, N. Y., I began railroading as a journeyman machinist, January 1, 1853, at the Susquehanna shops of the Erie Railroad, and after a few months there I went to the Martinsburg shops of the Baltimore & Ohio Railroad, where I was put in charge of a gang on general repairs on Ross Winan camelback engines for a year, working some on the Phineas Davis grasshoppers. I then went to Rochester, in the New York Central shops, for a few months, and was sent with an equipment of New York Central men to Fort Erie, Canada, on the Buffalo, Brantford & Goderich road, now a part of the Grand Trunk.

'In the spring of '55 I went to Zanesville, Ohio, on the Central Ohio Railroad, now a part of the Baltimore & Ohio Railroad, and in the fall went to Savannah, Ga., on the Georgia Central Railroad, returning the next spring to the Rochester shop of the New York Central until the spring of '57, when I went to Milwaukee shops of the Milwaukee & Mississippi Railroad, then to Watertown shops of the Milwaukee & Watertown Railroad, and in the fall went to Zanesville, Ohio, on the Central Ohio Railroad.

"In the summer of '58 was put in charge of the night work at Belleaire, Ohio, until the spring of '61 when I went to Jamestown, N. Y., on stationary work until the spring of '62, going to Dunkirk shops of the Erie Railroad until the spring of '63, when I again was transferred to the Zanesville shops of the Central Ohio Railroad as gang foreman until the spring of


Millvale June 5th
R V Wright
Dr Sir
I have been the only charter member for nearly two years and have the complete proceedings from the first but have not them at hand at present of course they contain all proceedings of moment but the conditions of railroadings January 1st 1853 were very crude when I commenced as a journeyman machinist at Susquehanna on the Erie and much could be written
I hope to be at the Marlborough Blenheim for the convention and would be glad to meet you
Truly Yours
H N Sprague

'65, when I was transferred to Cleveland, Ohio, as general foreman of the Cleveland and Pittsburgh shops until the spring of '66, when I went to Galion, Ohio, as foreman of the shops of the Atlantic & Great Western Railroad, now a part of the Erie system, and a few months later took charge of divisions 3 and 4 from Kent to Dayton, Ohio, as master mechanic until the spring of '69, having worked on all the five gages then in use, 6 ft., 5 ft. 6 in., 5 ft., 4 ft. 10 in., and 4 ft. 8½ in., when I took charge of the Smith & Porters Light Locomotive Works, the name changing to Porter Bell & Company, and now known as the H. K. Porter Company.

"Was a charter member of the Master Mechanics' Association, becoming ineligible in '69 as a locomotive builder, and joined again at the Baltimore convention as a locomotive builder, on motion of Howard Fry.

"Retired from H. K. Porter & Company and from active business in June, 1893."

ELECTRIC WELDING SAVES THE DAY

It has just leaked out that one of the big 3,000 hp. turbines of the Atlantic City Electric Company developed a very serious crack in its base support the day before the convention opened. The portable electric arc welding outfit which had then just arrived at the exhibit of the General Electric Company was called into service and rushed to the power plant of the electric company. The frame was completely welded in less than two hours after the arc welding machine got into operation and this was done without removing the turbine in any way from its own foundation. The arc welding set was back in its proper place in the exhibit of the General Electric Company within five hours from the time of leaving. This undoubtedly saved the day for the lighting and operating power features of the convention exhibits, for had this turbine been out of commission lighting and power on the pier would have been greatly curtailed.

Conventionalities

John Mackenzie, past president of the M. M. Association, was late in arriving at the convention because of the death of his son, who has been ill for some time.

R. D. Wilson, formerly general car inspector of the Philadelphia and Reading, is attending his first convention as a supply man. Since May 1 he has been representing the Grip Nut Co. in the East.

John W. Fraser, son of R. C. Fraser, Vice President of the Buffalo Brake Beam Company, graduated from West Point, June 13. He is assigned to the engineering corps, and due to the army increase bill, he will gain the rank of first lieutenant July 1.

Clyde P. Ross, contracting engineer of Roberts & Schaefer Company, came last year for the first time and is repeating this year. He is one of the big men at the engineering convention in Chicago in March each year and is now turning his attention to the mechanical conventions.

Lawford H. Fry, Standard Steel Works Company, the winner of the first prize in the *Railway Mechanical Engineer* competition on heat treated steel, was in attendance at the convention during most of last week, but found it necessary to return to Burnham on Saturday evening.

H. B. Oatley, chief engineer of the Locomotive Superheater Company, expected to get to Atlantic City on Friday night, but was prevented by the floods which have been causing trouble on the Pennsylvania. He was delayed 25 hours in returning from Erie, Pa., to New York.

Giving up their foreign trip this year, Mr. and Mrs. William O. Duntley, Chicago, are making an Eastern trip to various places of interest. They are accompanied by their son, Crawford A. Duntley, and are now at Atlantic City at the Traymore Hotel.

What we thought would happen has happened. Charlie Storrs has ploughed up and buried the section of pink South American shrubbery that Charlie Chaplined his upper lip. He says that public opinion, led by an enlightened press, forced him to act.

Hugh Montgomery, of the Rutland, who is stopping at the Dennis, is to be congratulated upon the remarkable record which he has made in reducing the maintenance costs of motive power on his road, whether considered from the standpoint of either mileage or ton-mile performance.

J. Osmer, superintendent motive power of the Ann Arbor, has been called home suddenly. Mr. Osmer expected to stay throughout the conventions, but found it necessary to return in order to meet some conditions arising in connection with one of the company's Lake Michigan car ferries.

Nathan H. Davis, one of the "steel back twins" and for some years responsible for the manufacture and sale of the Davis brake beam, arrived Monday morning with George Summers, for some years purchasing agent of the old Allison Car Works. Both expect to stay until Wednesday afternoon, attending the sessions of the American Railway Master Mechanics' Association and viewing the exhibits.

Top row standing—W. R. Hulbert (Goldschmidt Thermit Co.), E. A. Johnson (The Duff Mfg. Co.). Centre row—W. J. Fleming, Jr. (Automatic Ventilator Co.), J. A. Stevens (F. W. DeVoe & C. T. Raynolds Co.), S. Inglis Leslie (The Leslie Co.) and Arthur Haller (American Locomotive Co.). Bottom row—G. A. Barden (Chicago Pneumatic Tool Co.), L. D. Mitchell (Detroit Graphite Co.), C. H. Gayetty (Quaker City Rubber Co.), Chas. W. Beaver, Chairman (Yale & Towne Mfg. Co.), H. G. Thompson (Edison Storage Battery Co.), S H. Campbell (Western Railway Equipment Co.) and F. H. Smith (Gold Car Heating & Lighting Co.).

ENROLLMENT COMMITTEE

Otto Abrahamsen, of Beaudry & Co., Inc., Boston, Mass., was married June 14 to Miss Lois Barnes, of Chelsea, Mass. Mr. Abrahamsen has attended this convention for many years and has stopped here on his wedding tour, which will include Washington, D. C., Old Point Comfort and the Blue Ridge Mountains.

H. H. Vaughan managed to get away from Montreal long enough to spend part of Friday and all of Saturday and Sunday at Atlantic City. He was accompanied by Mrs. Vaughan and their son. Last year was the first year Mr. Vaughan missed a convention since his first one in 1898.

James Fitzmorris appears on the registration list as master mechanic of the Chicago Junction Railway. He is receiving congratulation, however, on the fact that he was made superintendent motive power of that road on June 1. Mr. Fitzmorris has been in the service of the Chicago Junction for 25 years as master mechanic.

C. L. Meister, mechanical engineer of the Atlantic Coast Line, is in the midst of the details of constructing a new home in Wilmington, N. C., his headquarters. He expects to have it ready for occupancy in a short time. He says that Mrs. Meister is now busy choosing the decorations and furnishings. The Atlantic Coast Line has had remarkable success in handling its boiler patching in compliance with the Federal requirements. All patches for boiler repairs are calculated and laid out in the office of the mechanical engineer and a blue print is furnished the shop doing the work.

The first words we utter after we grasp the hand of railway supply men are: "What's the news?" We tried that on Tom Litchfield, of the McCord Manufacturing Company, of Detroit. Tom grew thoughtful at once, scratched his high brow (not hyphenated either) and then smiled: "Oh, yes, Hartbauer is the proud Daddy of an eight-pound baby boy." Of course we knew that Tom referred to August Hartbauer, assistant superintendent of the McCord Manufacturing Company, Detroit, Mich., formerly of the railway supply department of the same company.

Perhaps the only pater-filius golf game which has been played at the conventions this year is one participated in by M. K. Barnum and his son, Edmund, and Burton W. Mudge and his son, Burton, Jr. At any rate, at was one of the closest. Mr. Barnum and Burton, Jr., played Mr. Mudge and Edmund. On seventeen holes the match was all square; and Mr. Mudge and Edmund won it by two points made on the last hole. Mr. Barnum, unfortunately, had to go home yesterday because of a strike in one of the Baltimore & Ohio's shops.

William Schlafge, general mechanical superintendent of the Erie, says that while he has always been very much interested in advertising in the railroad technical press, he does not understand just why he was selected to take the chairmanship of the committee of judges of the competition on advertising in the *Daily*. Because of his extended practical experience in the locomotive and car departments he is splendidly fitted to size the matter up from the standpoint of the railroad man to whom the advertisements are intnded to appeal.

One of our railroad friends at the convention, now a supply man, is a good citizen and believes in doing away almost entirely with the hyphen, although he was born in Scotland. He appreciates a good story, however, from his native country and therefore gives us this one: At a recent marriage ceremony the Scottish bridgegroom looked extremely wretched and uneasy. His "fussed" frame of mind was noticed by the best man who inquired: "What oop, Jock?" he whispered, "Have ye lost the ring?" "Na," answered the distressed one. "The ring be safe enough, but mon, I hae lost ma enthusiasm."

W. W. Melcher, of the Massachusetts Mohair Plush Company, left for Boston to-day to join his company in the national guard. Mr. Melcher is quartermaster sergeant, Co. K, Fifth Massachusetts Infantry, of which he has been a member for 14 years. At 1 o'clock this morning orders were received to report at 8 A. M. and at that hour 55 of the company reported ready for camp.

The Dearborn people can afford more direct evidence of their interest in preparedness than the two large electrically lighted American flags which they have in connection with their booth. George S. Norman, their New York manager in charge of sales, who is an adjutant in a Brooklyn regiment, has been called to the colors, and is all ready, with the full approval of his superiors, to go to Mexico. One of the flags referred to is in the Dearborn booth and the other is just outside it on the outside of the Pier where it can be plainly seen from the Broadwalk and the ocean.

George A. Post had to leave for Washington, D. C., yesterday after having spent a few days attending the conventions. We violate no confidence in saying that while he was here he participated in one of the fiercest golf contests ever pulled off. This was on Sunday morning. His opponent was William Schlafke. Mr. Post is a new recruit in the golf game, while Mr. Schlafke, as the *Daily* understands it, plays regularly once a year. The contest was finally won by Mr. Schlafke, but Col. Post insists that the blame for his defeat rests not upon himself, but on the committee that fixed Mr. Schlafke's handicap.

William H. Yetman, western railroad manager of the Pyrene Manufacturing Company, will become general railroad sales manager of that company on July 1. Mr. Yetman has been with this company but 14 months, entering the ranks as a salesman; later he was made western railroad manager, and now he will have charge of all railroad sales. E. L. Kent, eastern railroad manager, who has attended the Conventions for years, leaves the Pyrene Company on July 1 to join the forces of the Metal Hose & Rubber Company, New York, a new company in which he is interested.

Frank W. Thomas, supervisor of apprentices, of the Atchison, Topeka & Sante Fe, is here with the seven Sante Fe special apprentices who are taking a graduate course of instruction at the Baldwin Locomotive Works. These men are the pick of the apprentices from over the entire system and are sent to Baldwin's for a six-months' course to get experience in the various departments for the purpose of broadening their ideas. Of the seven men here three started in this course the first of this month. These boys are J. V. Stevens, E. Faulkner and C. Pinney. The other four men will complete their course the first of July. They are L. B. Johnson, P. J. Melchoir, E. J. Talevich and C. G. Sauerburg. Those men who completed the course the first of this month have returned to the road as gang foremen.

C. H. Crawford, assistant engineer motive power, Nashville, Chattanooga & St. Louis, reports that that road has in process of construction an all-steel dynamometer car of 1,250,000-lb. capacity. This car is being built for the purpose of obtaining definite information of locomotive performance over the entire road, which has several heavy grades. In the building of this car one of the bright graduate apprentice boys has been assigned to follow it through during its entire construction with the idea of having one man who is thoroughly familiar with the car, who will be placed in charge after it is completed. This work is in keeping with the progressive policy of this road,, which is making a strong effort to obtain definite and concrete information of the performance of its power.

One father who is here, J. W. Motherwell, made a contract with his two daughters before he left his home in Chicago. It was a business-like form of agreement, the reward to be an Eastern trip if success in final examinations were attained. Mr. Motherwell is therefore pleased in the receipt of a letter from home which reads as follows:

CHICAGO, JUNE 13, 1916.

DEAR DAD:

We received word about graduation today and are glad to report that we have fulfilled our part of the contract we made with you and we have both passed and hope to be graduated a week from next Friday and then take our journey eastward with you and that is the best graduation present to be had * * * * * We are going in town Friday to finish our purchasing (Poor Dad!) * * * If you are lonesome, cheer up! You won't be next time you go to Atlantic City for we will go with you.

Your loving daughters,

MILDRED AND RUTH.

The Eastern trip is therefore in order and will all the more be enjoyed by some of the most important members of the Motherwell family, because it was earned.

President Pratt and Granddaughter, Katherine VanTassel Barton

M. M. McCallister, inspector of building shops at Schenectady and Lima for the New York Central Railroad, has just accepted the position of expert of the American Flexible Bolt Company. Mr. McCallister was born at Curleysville, Pa. He began his business career as the first apprentice on the Pittsburgh & Lake Erie. When he left that road he was made field erector of the James P. Witherow Company, New Castle, Pa., manufacturers of the Heine boilers. From this position he went with the American Bridge & Iron Company in charge of the Roanoke, Va., shops, and later to the Norfolk & Western as assistant foreman of shops at Roanoke. He was next appointed assistant superintendent of the Richmond shops of the Richmond Locomotive Works, now a part of the American Locomotive Company. From there he left to become foreman boilermaker of the Lake Shore & Michigan Southern at Collinwood, Ohio. He was next appointed superintendent of the Erie City Iron Works, at Erie, Pa., leaving this position later to go as superintendent of John Brennan & Company, at Detroit, Mich., manufacturers of stationary and marine boilers. He was next appointed superintendent of the Weil Boiler Company, with headquarters at Indianapolis, Ind. While there he designed and put on the market the Weil smokeless boiler. From this position he went with the New York Central, which he now leaves to accept the above mentioned position.

The following has been handed to us by one our most esteemed contributors: "The exhibit by the Locomotive Pulverized Fuel Co. has many interesting features in addition to the principal one which shows an engine chewing fine-cut instead of plug coal. Among the collateral attractions on Saturday were two door mats spread on the track between the drivers. Dave Allen, who confesses he had something to do with bringing out the new fuel idea, had never before seen these mats, and as they were not shown in the blue prints, he investigated. Using them first as prayer-rugs and then as back rests, Dave explored up and down them fore and aft, but discovered nothing. Finally, meeting Muhlfeld, he asked what the mats were for. 'Well,' said John, 'some darned fool will come along and want to see the ash pan, and those mats are put down there so he can lie on his back and see that there isn't any.' "

F. J. Da Silva Freire, general superintendent of motive power of the Central Brazil Railway, Rio de Janeiro, Brazil, is making a two-month visit to this country at the suggestion of Dr. Miguel Arrojado Lisboa, director of that road, investigating railroad mechanical matters in general and powdered fuel-burning locomotives in particular. The use of powdered coal in Brazil is of particular importance, for the grade of fuel mined in that country is so poor that it is practically impossible to burn it on locomotives in other than the powdered form, making it necessary at this time for the roads to import their coal for this purpose. The South American bituminous coal runs from 23 to 29 per cent. ash, between 8,000 and 10,000 B. t. u., and is rather high in moisture. Dr. Friere arrived at Atlantic City last Friday. He has been a member of the Master Mechanics' Association for the last 11 years, this being however the first convention he has attended. While here he plans to thoroughly investigate the North Western and Delaware & Hudson powdered fuel engines.

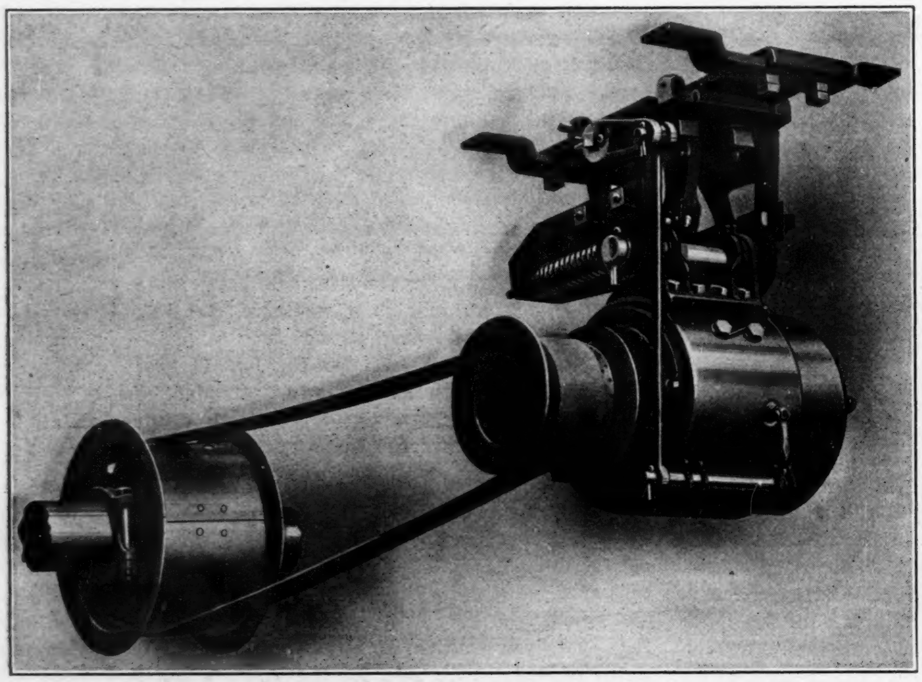
L. W. Wallace, professor of railway and industrial management, Purdue University, is conducting some unique tests on the effect of scale in locomotive boilers. A locomotive from one of the roads in the vicinity of the university was taken just as it came from the shops in a perfectly clean condition and an evaporative test was made. This locomotive was then put into service on a certain division on which one grade of water was used for the entire time, this water being of a bad scaling nature. Monthly tests have been made for the past seven months and it is expected that twelve more monthly tests will be made before the locomotive is returnd to the shops for general repairs. The results of these tests will contribute valuable information to the effect of scale on the evaporative efficiency of locomotive boilers.

G. R. Joughins, superintendent rolling stock, Canadian Government Railways, now has charge of mechanical matters on the National Transcontinental which was built by the Canadian Government for the use of the Grank Trunk Pacific east of Winnipeg. This road is now being operated by the Government and through passenger service is being provided between Toronto, Ont., and Prince Rupert, B. C., in connection with the Grank Trunk Pacific west of Winnipeg. The large locomotive and car repair shops at Transcona, Man., near Winnipeg, are also under Mr. Joughins' charge and the heavy repair work on locomotives of the Grand Trunk Pacific is carried out at this plant through an arrangement between the railway company and the Government.

New Devices

U. S. L. BODY HUNG GENERATOR

The U. S. Light & Heat Corporation, Niagara Falls, N. Y., have on exhibition a body hung generator and suspension that has attracted considerable attention on account of the simplicity and novelty of design. The generator is supported by a horizontal pivot-pin passing through lugs on the top of the generator frame and lugs forming parts of a hanger casting which is bolted to a supporting plate attached to the sills of the car. The hanger casting is fastened to the plate by five bolts arranged like a "five spot." The middle bolt forms a pivot about which the hanger casting may be rotated by adjusting set-screws to secure an exact parallelism of generator shaft and car axle. When finally adjusted all bolts and set-screws are set up and locked, making the adjustment permanent. The tension of the belt is maintained by means of a vertical tension rod which is attached to the generator below and behind the pulley and engages at its upper end with a horizontal lever mounted upon a square shaft journaled in suitable bushings in the hanger casting. On this shaft and between the depending arms of the hanger casting is a second crank arm, to which is attached a horizontal tension rod, supported at its outboard end by a wrought-iron yoke, which also forms the fixed abutment for the tension spring which surrounds the horizontal tension rod.



The U. S. L. Body Hung Generator

A gravity tension-nut is employed to adjust the tension on the spring and hence on the belt. As the belt centers lengthen and the generator is pulled toward the axle the moment arm of the vertical tension rod decreases rapidly, thus reducing the tension due to further compression of the spring, thus maintaining the belt tension constant. A movement in the opposite direction produces an opposite effect. The tension spring and nut employed are the same standard parts as used on the familiar truck suspension. The suspension and tension parts may be quickly and easily taken down and reassembled. All wearing parts are bushed so that maintenance is provided for.

The corporation has a complete running exhibit of its standard equipment and invites especial attention to its ampere hour meter system of control.

CAPACITY REGULATION FOR AIR COMPRESSORS

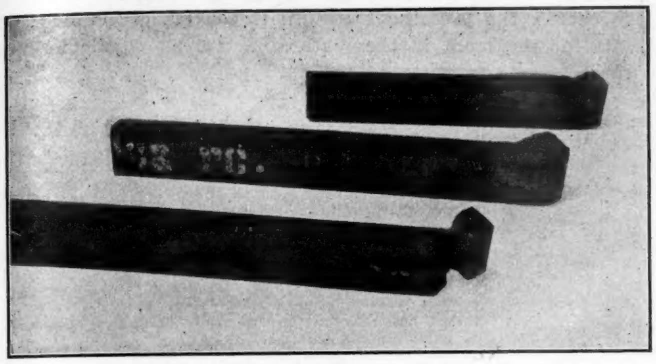
Among the recent developments in air compressor practice which are being exhibited is a system of capacity regulation brought out by the Chicago Pneumatic Tool Company, Chicago. This regulation consists of holding open by air pressure certain air-inlet valves and returning to the atmosphere a portion of the air drawn into the cylinders. In this way a delivery equal to the demand is obtained, with increased economy at all underload points. On medium sized machines the regulation is two-step, and on compressors with a stroke of 14 in. and over, four-step regulation is used when service conditions make it desirable.

For the two-step control unloading inlet valves are provided. One of the differential unloaders is piped to the inlet valves at the head end of the high-pressure cylinder and the crank end of the low-pressure cylinder. The other is piped to the inlet valves at the crank end of the high-pressure cylinder and head end of the low-pressure cylinder. The first unloader is adjusted to operate at a pressure of 100 lb., and the second at 104 lb. Operation of the first unloader holds open the inlet valves at opposite ends of the high and low-pressure cylinders, so that air is compressed in only one end of each cylinder, and the compressor operates at half load. When the other unloader operates, the rest of the inlet valves are held open and it runs under no load.

The four-step regulation is similar except that four unloaders are employed, and to provide the four steps two intermediate sets of valves in the air cylinder are located midway in the stroke of the piston. The unloaders are piped to alternate ends of the cylinders, so that when the crank end of the low-pressure cylinder is unloaded the inlet valves at the head end of the high-pressure cylinder are also held open, giving, as nearly as can be obtained, a balanced condition for each complete revolution and at the same time maintaining the correct cylinder ratio. The unloaders are set to operate at about 2 lb. difference in pressure between the successive steps. For example, the first unloading step will occur at 98 lb. pressure, the second at 100 lb., the third at 102 lb. and the fourth step at 104 lb., when the compressor will be completely unloaded. In the individual unloader the range between the point of loading and unloading is about 8 lb., so that the pressure drops to 96 lb. before the first step goes into action again, and the next three steps operate at 2-lb. intervals.

ARC WELDED CUTTING TOOLS

With the present price of high speed tool steel it has been found economical to build up cutting tools with a small piece of high speed tool steel electrically welded onto a shank of ordinary tool steel. The Westinghouse Electric & Manufacturing Company, of Pittsburgh, have been very active in this development and the process by which the tools are made is clearly shown in the illustrations. This company states that by means of arc welding their cutting tool tips they have been able to build up a more solid shank which has given more satisfactory results and at a considerably cheaper price than by any other process. This conclusion has been reached after exhaustive tests employing oxyacetylene, incandescent electric (butt welding) and forging methods.



High Speed Tips Welded on Common Tool Steel

For best results the current used for this work is approximately 100 amperes and the voltage of the welding circuit approximately 60 to 70 volts. A 5/32 in. Norway iron electrode is used. The tools are preheated before welding, and annealed by being buried over night in mica dust or lime. They are then put through a process of heat treatment which materially improves their cutting qualities.

The results with this built-up cutting tool are very satisfactory, as shown by a sample lathe tool at this company's exhibit, which cut 104—4½ in. .60 carbon steel cylinders, 14 in. long at a cutting speed of 57 ft. per minute with a cut of ¼ in. depth and a feed of .047 in. per rev.

An accurate record has been kept of this welding work and it shows that electrically welded tools will actually produce 10 per cent more work than solid tools, before regrinding is required. This is believed to be due to the reinforcing metal which is built out and around the tip, serving both to give large radiating surface and to afford a larger heat conducting path back to the butt of the tool, thus keeping down temperature at the cutting edge. At present practically all the tools for the lathes and planers used by the Westinghouse Company are made in this way.

The composition of the high speed steel is comparatively unimportant as nearly all commercial brands are being welded successfully. The records on this type of welding show that so long as high speed tool steel costs over $1.25 per lb. it will be economy to weld tips on cutting tools.

CAR REPLACERS

A type of car replacers is being exhibited by the Reading Specialties Company, Reading, Pa., which possesses several features of interest. These replacers are so designed that the treads of the wheels are picked up, the flanges not coming in contact with the replacer on the outside under any conditions and only when the wheel is high enough to be pushed over the top of the rail on the inside. Both replacers are provided with lugs on the side next to the rail, which fit up under the head of the rail and keep the replacers from being overturned. The bases are wide and are so designed that a large part of the load is carried to the base of the rails. On the inside the lugs which set up under the head of the rail also provide a flangeway between the replacer and the ball of the rail, which prevents the flange of the wheel from sliding over the top of the rail or crowding the replacer away from the rail. The outside replacer has been so designed that no trouble is experienced from the truck column bolts catching and preventing the wheel from passing over the top of the rail.

The replacers are held in position by a special type of clamp which is shown in position in the illustration. This is a yoke placed under the rail, a permanent jaw gripping the inside of the base of the rail for the outside replacer, and the base of the replacer for the inside replacer. The outside jaw is locked against the base of the replacer or the rail, as the case may be, by a wedge which is driven into place. These clamps greatly facilitate setting the replacers.

Reading Car Replacers

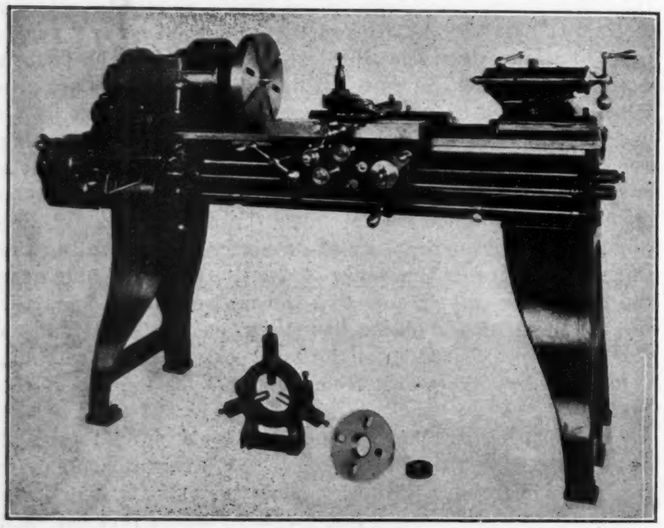
ASHTON LOCOMOTIVE GAGE

A steam gage is being exhibited by the Ashton Valve Company, Boston, Mass., which possesses several features of special interest. It is of the Lane-Bourdon type and combines the sensitiveness of the standard test gage with the durability of the No. 52 locomotive gage manufactured by the same company. The double tubing is of the seamless, cold-drawn type and insures the least liability of damage from freezing. It is provided with a wide sector and pinion of German silver, and the moving parts are bushed with the same materials, making it non-corrosive. Each dial is made to correspond with the individual movement of the gage. The case is dustproof.

LATHE FOR TOOL ROOM SERVICE

A 12-in. close-coupled lathe is being exhibited by the Davis Machine Tool Company, Inc., Rochester, N. Y., which was recently developed to meet the requirements of the tool room for a high-speed, accurate machine capable of withstanding heavy duty.

The headstock is a heavy casting with the front and rear bearings tied together by side walls extending up to the center of the spindle, thus providing a guard for the lower half of the cone pulley. The gears are also covered by guards which are made integral with the head. The back gears, instead of being mounted in lugs at the rear of the head, are placed underneath, between the front bearing and the cone. This arrangement applies the power through the gears without the long eccentric shaft and quill, the close coupling eliminating the torsional strains. These gears are brought into operation by a handle just below the feed rod, at the head end, which is within convenient reach of the operator.



Davis Close Coupled Lathe

When a lathe is placed on an uneven floor the alinement is lost, regardless of the accuracy with which it may have been finished. To provide correct alinement under any condition of service a foot has been placed in the center of the right leg, which is designed to carry the weight of the tail-stock end. This provides a three-point support for the lathe and insures freedom from abnormal strains in the bed. To eliminate any tendency to rock, bolts are placed in the ends of the leg, which should be set to just touch the floor without carrying any weight. This feature is patented.

A motor may be fitted to the head for direct motor drive, a variable speed motor being used. A 1¼-h.p. motor with a speed range from 500 to 1,500 revolutions per minute is recommended.

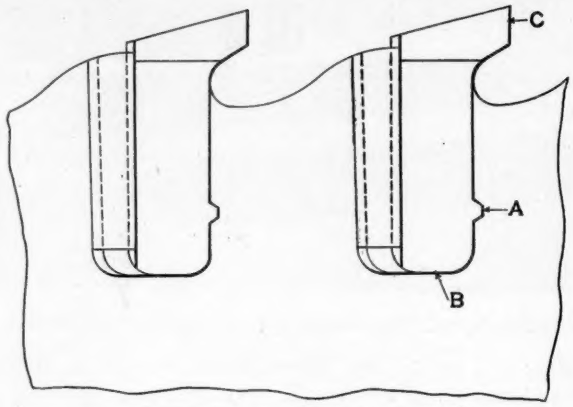
PISTON ROD PACKING FOR SUPERHEATED STEAM

A type of piston rod packing has recently been developed, the outstanding feature of which is the automatic adjustment of the parts to the rod to suit all conditions of operation. When the locomotive is drifting the pressure on the packing is released, as there are no springs to hold it hard against the rod. This freedom of adjustment reduces the tendency to cut or score the rod when drifting.

This packing is manufactured and is being exhibited by B. M. Jones & Company, Inc., Boston, Mass. It has been tested during a period of over 15 months and the results are said to have been satisfactory.

INSERTED TOOTH METAL-CUTTING SAW

A new type of teeth inserts for metal-cutting saws is being exhibited by the Simonds Manufacturing Company, Fitchburg, Mass. Aside from the perfect clearance of the cutting point, both backward on the periphery and downward toward the center, the prominent feature is the projection *A*. The seats for the teeth in the plate at *B* are an equal distance from the center. The tooth being seated firmly at this point insures that the saw will be perfectly round. The projection *A* holds the tooth firmly in this position and makes it unnecessary to drive the wedges hard enough to disturb the tension of the saw, or distort it in any way. The teeth are accurately milled to length, the angle on the top being the same in each tooth. The saw can be sharpened by simply grinding the face of the teeth at *C*, which makes it unnecessary to remove the teeth once they are inserted until they are worn out.



The Simonds Inserted Saw Teeth

RECLAIMING BOILER TUBES

A set of attachments is being exhibited by the Draper Manufacturing Company, Port Huron, Mich., which has been developed for use with the Draper pneumatic flue welder and any ordinary flue furnace, which makes possible the welding of long-ends on boiler tubes. The flue welder is placed behind the furnace with the end of a long mandrel central between the dies and in line with the center of the furnace. A water back is placed between the furnace and the welder to keep the latter cool, and in this is a cored hole through which the tube passes. The operator in front of the furnace is protected in a similar manner.

The tubes to be welded are prepared in the ordinary manner; the shorter piece is then pushed through the furnace onto the mandrel and the other piece inserted into or over the lap, the part to be welded being pushed to the center of the furnace. A clamp is then placed on the tube a certain marked distance back of a forked operating lever, this distance being equal to the distance between the center of the furnace and the center of the welder. When the tube is at the proper welding temperature it is pushed forward into the welder until the clamp engages the forked lever and opens the operating valve. This automatically operates the welder when the weld is under the dies. The weld is thus made a very few seconds after it leaves the fire, decreasing the chances of a poor weld.

After the tube is welded the clamp is thrown off and the tube pulled out onto a tilting table which has been placed in line to receive it. Throwing this table back into position causes the tube to roll over, thus straightening itself. It then cools on the table.

By this process ends of any length may be welded on the tubes, depending only on the length of the mandrel behind the welder.

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DAILY EDITION

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WE GUARANTEE that of this issue 12,715 copies were printed; that of these 12,715 copies, 11,244 were mailed to regular paid subscribers to the Railway Age Gazette and the Railway Mechanical Engineer; 171 were mailed to advertisers, 300 were provided for counter and news companies' sales, new subscriptions, bound volumes, copies lost in the mail and office use, and 1,000 copies for distribution at Atlantic City.

THE RAILWAY AGE GAZETTE is a member of the Audit Bureau of Circulations.

Heating Electrically Operated Trains

It is not generally realized that there has been and still is great difficulty in obtaining a suitable steam boiler installation on electric locomotives for heating through line passenger trains. The space available in the locomotive is limited and the steam supply for heating a 12 or 15-car passenger train in the coldest months places exacting requirements on a boiler that will fit into this space. After a great deal of experimenting one of the larger roads which operates electric locomotives has only recently developed a boiler that is satisfactory for this purpose and other electrically operated roads have not yet reached a solution of the problem. Considering the increase in the number of main line electric installations in recent years it would seem desirable that the American Railway Master Mechanics' Association should appoint a committee to go into this matter thoroughly and arrive at some definite conclusions as to the most suitable type and size for boilers for this purpose.

The Work of the Traveling Engineer

During the discussion of the question of fuel economy Tuesday morning C. F. Baker brought out a point the truth of which has long been realized and concerning which not enough has been said; that is, the value and importance of the traveling engineer. The traveling engineer is a man who is selected from the most efficient and able enginemen for the purpose of supervising engine crews over certain defined districts. He is called upon to educate the crews in the proper use of fuel and the handling of the locomotive, to see that the men properly observe train rules and to investigate engine failures as they occur. His duties are numerous and the tendency is to so add to them that he cannot perform any one set of them well. Another point brought out by Mr. Baker was the compensation of traveling engineers. These men are called upon to give up their runs on which it is possible for them to make more money than working as a road foreman. This condition should be corrected and adequate salaries paid them. Both their work and responsibility are greatly increased, and such conditions demand ample compensation. It is vitally necessary that the men be carefully chosen for this important work. Their opportunities for assisting in the saving of fuel are very large and only by giving them the proper support will it be possible to obtain their maximum efficiency.

Types of Locomotives Ordered

The orders for locomotives placed thus far this year have been characterized by the tendency towards the larger and newer types. Of the total of 1,692 locomotives noted in yesterday's *Daily* as having been ordered between the first of the year and June 10, 533, or 31 per cent, were Mikados; 163, or 9 per cent, were of the Santa Fe type, whereas only 57, or 3 per cent, were Consolidations. These figures compare with previous years as follows:

	Mikado		Santa Fe		Consolidat'n		Total of all Locomotives
	No.	Per Cent	No.	Per Cent	No.	Per Cent	
1912	1309	29	0		858	19	4515
1913	796	23	0		823	24	3467
1914	333	26	63	5	166	13	1265
1915	562	36	75	5	194	12	1573
1916—to June 10	533	31	163	9	57	3	1692

The Mikado type locomotive began to take precedence over the Consolidation some six or seven years ago, and in each year since 1910, with the single exception of 1913, more Mikados have been ordered than any other type. The Consolidation lost its prominence in 1914, the Pennsylvania Lines West being one of the very few roads which ordered new engines of that type in 1914 and 1915. Now that the Pennsylvania Lines have turned to the Mikado type, the orders for Consolidations have been but few, and in the past six months but three per cent of all the orders for locomotives have been Consolidations, as against 19 per cent in 1912, or 24 per cent in 1913. It is also interesting to note that the 163 Santa Fe type locomotives ordered so far this year are more than were ordered in 1915 and 1914 combined, and that there have also been several other inquiries for locomotives of this type which had to be withdrawn because of high prices. The Mountain type locomotive is also becoming important. Thus far this year there have been orders placed for 49 Mountain type locomotives, as compared with 9 in 1915, 12 in 1914, 24 in 1913 and 2 in 1911; or as against a total of 47 in the past five years.

Mechanical Improvements and the Stockholders

There has been a marked change in the last five or six years in the amount of consideration given in annual reports of railroad directors to their stockholders in regard to improved methods of operation and especially to what might be called the technique of such improvements. Of the annual reports of the more important railroads which are reviewed in the *Railway Age Gazette* each year, a very considerable proportion in 1915 mentioned progress in the mechanical department as a factor in the more economical operation of the railroad. A notable example of this was the Pennsylvania's report for 1915 which specifically mentioned the superheater as contributing to fuel economies and by implication gave credit to the work which is being done in designing locomotives to meet the specific requirements in the way of operating conditions to which they are to be subjected. The Missouri, Kansas & Texas mentions the purchase of new Mikados as enabling the movement of heavier tonnage trains. A large number of roads mention the equipment of a certain number of locomotives with super-

heaters and some mention locomotives which have been equipped with mechanical stokers. The Central Georgia specifically mentioned applying wide fireboxes with combustion chambers. The Northern Pacific mentioned the increased tractive power of locomotives as being due in part to the application of superheaters. The inclusion of the remarks of this kind in the annual reports to stockholders is a good thing from at least two points of view. It indicates that the managements believe the stockholders are taking a more intelligent in the operation of their property and it is a recognition of the importance which a scientifically managed mechanical department may have in the earning of dividends. The old attitude of regarding a mechanical department only as a source of expense is changing.

The Cost of Lubrication

A point worthy of special mention was brought out by G. W. Wildin in the discussion of the report on Superheater Locomotives. Economy in lubricating oil is as essential as economy in anything else; but, as in many other instances in railway service, there are liable to be bad effects, resulting from the desire to keep down the amount of oil used, which will considerably impair the economy of the locomotive as a whole. Mr. Wildin referred to the possible saving of oil and indicated plainly the greater possibilities of fuel saving by the use of a reasonable amount of oil. Some mechanical department officers seem to have a mania for keeping the amount of lubricant used to the lowest possible point, regardless of whether or not it is evident on the face of it that the locomotives are not receiving sufficient lubrication in the valve chests and cylinders. Improper lubrication, as indicated by Mr. Wildin, has a very direct bearing on increasing fuel consumption. As regards its effects on the working parts of the locomotive, there need be no special reference made, the results of a lack of oil being sufficiently well known. The point which it is desired to bring out particularly is that there is a great deal of twaddle in the continual harping on saving on lubrication. The goal at which to aim should rather be the correct amount of oil to be used in order to permit the locomotive always to work the most economically.

Co-operating with Other Associations

The report of the Committee on Co-operation With Other Railway Mechanical Organizations brings out the need for a better co-ordination of the work which is being done by the various associations in this field. The proposed combining of the Master Car Builders' Association and the Railway Master Mechanics' Association has received much attention during the past few years, but comparatively little has been said relative to including the other associations in any plans which have been suggested toward this end, and practically nothing has thus far been accomplished so far as the two larger organizations are concerned. Last year in his address President Gaines referred to this matter when he stated that it was his belief that the time had come when all of these associations should be brought into one organization, divided into such sections as might be found advisable. Under instructions from the Executive Committee, the committee of the Master Mechanics' Association previously referred to was appointed to investigate the costs of doing various classes of shop work and has found the assistance of several of the other associations of value in carrying out this purpose. When a committee in one association finds that the subject on which it is to report can best be dealt with by obtaining information through one of the other organizations, there would seem to be a duplication of work and consequent waste of energy, and it should lead to careful consideration of Mr. Gaines' suggestion that something be done to bring about a co-ordination of the work of all of the associations that will eliminate the duplication of effort which now obtains.

Superheating Slide Valve Locomotives

There was a very free discussion at Tuesday's session on the use of superheated steam on slide valve locomotives. Both the Lackawanna and the Buffalo, Rochester & Pittsburgh seem to be having considerable success with the locomotives thus equipped. A good deal of success has been obtained by modernizing locomotives in such a way that any difficulty due to the use of the slide valve is eliminated. This method has been tried out to a sufficient extent to indicate that it is not merely experimental. But as regards those slide valve, saturated steam locomotives which should still have a life of 15 and 20 years, and which are about to be equipped with superheaters, there is food for careful thought in the point brought out in the discussion that as the locomotives are likely to require new cylinders at a later date, the expense of applying them at once would be justified by the possibility of improved results due to increasing the tractive effort, which can be done because of the increased weight on drivers accompanying the application of the superheater. On the other hand, the boiler pressure can be reduced, thus providing a boiler with a longer life and lower charges for maintenance. The problem of converting or modernizing existing locomotives is one which needs careful study from the standpoint of local conditions, the increased life to be obtained from the locomotive, and the increased capacity, as the methods pursued in one case may not justify their use in another.

Locomotive Fuel Economy

While the report of the Committee on Fuel Economy and Smoke Prevention covered quite thoroughly the development of supervision for fuel economy on locomotives, but little was said of the effect the other departments of a railroad have on this important subject. There is no question that the methods of conducting the work of the transportation department have a decided effect on the consumption of fuel. Poor dispatching of trains, calling engines for service too long before they are needed, stopping trains unnecessarily and at places where they are difficult to stop, allowing slow orders to remain in effect unnecessarily long—all these contribute to unnecessary fuel consumption. The enginemen, of course, are the ones who are most directly concerned with the consumption of fuel, but they must not be expected to do all there is to be done without the co-operation of others. They should be furnished with engines in good condition, with which to work, given every possible means to expedite their trips over the road and made to feel that the road as a whole is not putting the entire fuel problem solely up to them. Coal chutes must be conveniently located and so designed that they do not produce a preponderance of slack from the coal put into them. The proper sizing of the coal for use on the locomotive is also of vital importance. If the men are to be expected to do their best they must be assisted by their superiors and the other departments which are associated with the fuel problem.

How About Your Chief Clerk?

Many mechanical department officers are necessarily out of their offices and on the road much of the time. Who supervises and handles the details of the work of the department while they are away? The chief clerk, and usually he does it well. Is the chief clerk often promoted to a more important position in the mechanical department? No, sometimes! Is there not something fundamentally wrong with such a system? Is he not, because of his intimate knowledge of the details and the working of the department as a whole, a logical man to move up into a position of greater authority? If he lacks

in the knowledge of certain practical details of the outside work, should he not be given an opportunity, before or after he is made chief clerk, to secure a practical knowledge of such work in order that he may better fit himself for a higher position toward which the chief clerkship is but a stepping stone? Are the motive power and car departments not missing a great opportunity in the interests of more efficient organization by making the chief clerkship a blind alley job? Is it not time that more real intelligent study in a big way was given to the logical development of a system of selection and promotion of men in railway mechanical departments? Why drift along with the tide when a day of recognition is bound to come and you might far better be found in the front ranks rather than in the rear guard? Is not the importance of this question so great that the big mechanical department associations can well afford to study it and make definite recommendations as to the best practices?

CHICAGO OR ATLANTIC CITY?

EACH year there is much discussion of the question as to whether the mechanical associations shall return to Atlantic City to hold their conventions the next year. There has been, from time to time, great dissatisfaction with certain of the conditions under which the conventions are held in Atlantic City; but until recently there has been no place in the country except here where there was a single building large enough to accommodate the exhibit. This has ceased to be the case, because the City of Chicago recently has erected a pier much larger than any in Atlantic City. In consequence, there has been a renewal of discussion as to the advisability of holding the conventions in Chicago. In fact, the holding of this year's conventions there was seriously considered; and there have been many confident predictions that they would go there next year.

Chicago has many advantages as a place for holding ordinary conventions, and it seems probable that the mechanical associations will some time make the experiment of going there. But the *Daily* does not believe it would be desirable to do this next year. One objection is that it would be necessary to scatter the convention crowd through all the downtown hotels, and, while they might be able to accommodate it, there would not be that opportunity for those attending to mingle together constantly, to get well acquainted, and to interchange experiences and views, which are such valuable features of the meetings here.

But the worst phase of the situation in Chicago is the location of the pier. It is on Lake Michigan at the end of Chicago avenue. This is from one and a half to two miles from the large hotels, and can be reached only by one street car line. In order to reach it by this line it is necessary for all persons coming from downtown to change cars at least once; and those coming from the Michigan avenue hotels must either walk a long distance to a street car line or change more than once. The only alternative to using a street car is to go by automobile; and in either event it is necessary to pass through a manufacturing and wholesale district which is dirty and unsightly. If the sessions of the conventions were held on the pier, it would be necessary for those attending them to go clear downtown for lunch and dinner, and it is probable most of them would be strongly indisposed to make the long trip back in the afternoon or at night. In other words, it seems probable that the railway men would mingle much less together outside of the meeting hall and see much less of the exhibit than they do in Atlantic City; and these would be very serious drawbacks.

An advantage of holding the conventions in Chicago would be that they probably would be attended by many western railway men who do not come to them now; but the advantages to be derived from returning to Atlantic City seem greater than those which would be gained by going to Chicago.

TODAY'S PROGRAM

The report of the Committee on The Best Design and Materials for Pistons, Valves, Rings and Bushings was presented at yesterday's session, but it was necessary to carry the discussion over until this morning. Similar action was taken with regard to the report of the Committee on Co-operation with Other Railway Mechanical Organizations. The individual papers included in this report will be read during this morning's session.

Discussion of Reports on:

Powdered Fuel	9.30 A. M. to 10.00 A. M.
Specifications and Tests for Materials	10.00 A. M. to 10.30 A. M.
Modernizing of Existing Locomotives	10.30 A. M. to 11.00 A. M.
Train Resistance and Tonnage Rating	11.00 A. M. to 11.30 A. M.
Subjects	11.30 A. M. to 11.45 A. M.
Topical Discussion:	
Best Method of Introducing Oil to Cylinders of Superheater Locomotives	12.15 P. M. to 12.30 P. M.
To be opened by Mr. Jos. Chidley.	
Resolutions, Correspondence, etc.	12.30 P. M. to 12.45 P. M.
Unfinished Business	12.45 P. M. to 1.00 P. M.
Election of Officers, Closing Exercises	1.00 P. M. to 1.30 P. M.
Adjournment.	

REGISTRATION FIGURES

Following are the official enrollment figures, as shown by Book 5, for the six conventions since, and including, 1911:

	1911	1912	1913	1914	1915	1916
Members M. M. and M. C. B.	719	644	678	730	713	754
Special Guests	832	584	680	554	507	722
Railroad Ladies	705	437	505	433	403	544
Supply Ladies	385	223	308	287	232	318
Supply Men	1662	1516	1666	1484	1248	1533
Totals	4303	3404	3837	3488	3103	3871

LADIES' CARD PARTY

The Master Mechanics' euchre party was held yesterday afternoon at the Marlborough-Blenheim. When play was called it was found that there were 115 ladies in attendance. Following the playing of nine games, and while the scores were being counted, refreshments were served.

The committee in charge was Mrs. E. W. Pratt, chairman; Mrs. B. P. Flory, Mrs. W. L. Kellogg, Mrs. D. R. MacBain, Mrs. E. A. Simmons, Mrs. L. B. Sherman, Miss A. G. Hogan, Mrs. H. B. Bailey, Mrs. T. Moran.

Mrs. G. E. Hulse was the only one with a perfect score; as first prize she selected a very handsome silver mesh purse. Nine ladies tied for second place, and drew lots as follows: Mrs. H. B. Hayes, silver vegetable dish; Mrs. A. La Mar, silver pitcher; Mrs. Charles Deaner, luncheon set; Mrs. P. C. Withrow, silver flower dish; Mrs. J. Mills Summers, silver sandwich tray; Mrs. I. J. Justus, desk set; Mrs. D. R. MacBain, colonial candlestick; Mrs. James K. Cullen, silver vanity case; Mrs. F. A. Hugo, parasol. Fourteen ladies tied for third place, with a score of seven, as follows: Mrs. C. Young, chocolate pot; Mrs. B. W. Mudge, Dresden compote; Mrs. A. L. Whipple, sugar bowl and cream pitcher; Mrs. L. H. Swinet, silver vanity case; Mrs. J. F. Sheahan, tea set; Miss Mary Peebles, napkin; Mrs. W. J. Hartman, Egyptian vase; Mrs. A. J. Fries, Egyptian compote; Mrs. W. A. Bennett, parasol; Mrs. W. G. Wallace, japan tray; Mrs. R. J. Himmelright, silver baking dish; Mrs. William H. Hill, cut-glass pitcher; Mrs. P. M. Elliott, fan; Mrs. George Laughlin, coffee percolator.

FOUND

Jeweled Hair Pin; also a Silver Lorgnette. Please call at the office of the *Daily* and leave badge number of the loser.

THE MUSIC

The music furnished by the Don Richardson New York Orchestra at the informal dance and for the morning and evening programs has received much favorable comment. The numbers which attracted the greatest attention were the "Betty Lee" waltz and "Hezekiah," composed by the leader, Don Richardson; also "Hello! Hawaii," "Yaaka Hula Hickey Dula" and "They Didn't Believe Me."

ELEVENTH ANNUAL CORNELL DINNER

Thirty-three Cornell alumni were present at the eleventh annual dinner, held at the Traymore on Saturday evening. "Jack" Moakley, the famous coach of the track team, and Professor A. E. Wells, of Sibley College, were the guests of honor. W. L. Bliss, as president, acted as toastmaster. Coach Moakley told some of the secrets of how he has managed to develop teams that have won so many intercollegiate meets. He told also of the constantly growing appreciation, both by the student body and the faculty, as to the value of the physical education, offered by athletics as a part of a real college education. Many hundreds of students now take part in the various athletics, where but scores did so ten years ago.

Professor Wells explained the present methods of teaching "shop" at Sibley. Lantern slides were used to illustrate the new buildings and equipment and to show the character of work performed. Intensive production methods are followed in all departments, while still retaining sufficient of the extremely accurate exercises to prevent a misconception in the student's mind that all character of work can be safely performed on a high-speed schedule.

For the first time it was the sad experience of this group to drink a silent toast to a departed member. The memory of the much-loved Jim De Voy was honored in that way.

A. G. Trumbull, assistant general mechanical superintendent of the Erie, was elected president, and A. S. Lewis, of the Chicago-Cleveland Car Roof Co., New York, secretary for the coming year:

MASTER MECHANICS' BALL

Members of the Master Mechanics' Association rejoiced last night in the knowledge that the attendance at their annual ball on the Pier exceeded all previous records for attendance at this important social function. When the grand march was well under way it was also seen that the attendance was greater than that at the M. C. B. ball last Thursday night. When the march finally ended and the flash-light photograph was taken, the checkers for the Entertainment Committee reported to Chairman Ryder that over 1,000 people had taken part in the march. The special feature was the presentation of a fan to every lady in the march. There were 16 dances on the program, and a liberal number of encores was given. The Richardson Orchestra and the Marimba Band furnished excellent music.

The committee in charge of the dance were: B. A. Clements, chairman; George W. Denyvan, L. S. Hungerford, A. G. Bancroft, W. T. Kyle, C. W. Floyd Coffin, D. E. Sawyer, C. C. Schumaker, W. H. Bentley, F. N. Roe, F. V. McGinness.

Top row, left to right—Dan Eubanks (Galena Signal Oil Co.), G. E. Spengler (Locomotive Superheater Co.), J. R. Forney (Ralston Steel Car Co.), H. E. Passmore (Grip Nut Co.), E. H. Bankard, Jr.. (Cambria Steel Co.).

Middle row—C. W. Sullivan (Garlock Packing Co.), Don L. Clements (Pratt & Lambert), George W. Denyvan (The Parkesburg Iron Co.), Wm. T. Kyle (Okonite Co.), F. V. McGinness (Edison Storage Battery Co.), D. E. Sawyer (Illinois Steel Co.), F. N. Roe (Carnegie Steel Co.).

Bottom row—A. G. Bancroft (Standard Railway Equipment Co.), John D. McClintock (William Sellers & Co.), C. W. Floyd Coffin (Franklin Railway Supply Co.), Gilbert E. Ryder, Chairman (Locomotive Superheater Co.), Langley Ingraham (Yarnell Paint Co.), L. B. Sherman (*Railway Age Gazette*).

ENTERTAINMENT COMMITTEE

Master Mechanics' Association Proceedings

Tuesday's Session Included Important Committee Reports; Also an Individual Paper and Topical Discussion

PRESIDENT Pratt called the meeting to order at 9:40 A. M. The Committee on Nominations have presented the following report: For president, William Schlafge, Erie; first vice-president, F. H. Clark, Baltimore & Ohio; second vice-president, W. J. Tollerton, Chicago, Rock Island & Pacific; third vice-president, C. F. Giles, Louisville & Nashville; treasurer, Angus Sinclair. The following were nominated for executive members: John Purcell, A. T. & S. F.; M. K. Barnum, B. & O.; W. E. Dunham, C. & N. W., and M. A. Kinney, Hocking Valley, Mr. Kinney being nominated to fill the unexpired term of J. F. DeVoy, deceased. These officers will be voted on today.

Report on Fuel Economy and Smoke Prevention

An examination of the proceedings of the Association since its organization in 1868 shows very clearly that the fuel question is not a new one, it having received more attention than any other one subject. Serious attention has been given to the economical use of fuel, however, only since 1909. A committee, of which W. C. Hayes was chairman, presented a report at the 1909 convention, and Mr. Hayes read a paper on fuel economy the following year. In 1911 the first smoke prevention report was presented, the subject again being taken up at the 1913 convention. Committees reported on both subjects in 1914, and were made standing committees for last year. Both subjects have now been given to the committee of which Mr. Schlafge has been chairman for several years.

William Schlafge, general mechanical superintendent, Erie Railroad, is chairman of the committee. The other members of the committee are: W. H. Flynn, superintendent motive power, Michigan Central; D. M. Perine, superintendent motive power, Pennsylvania Railroad; Robert Quayle, general superintendent motive power and car department, Chicago & North Western; F. H. Clark, general superintendent motive power, Baltimore & Ohio; D. J. Redding, assistant superintendent motive power, Pittsburgh & Lake Erie, and W. J. Tollerton, general mechanical superintendent, Rock Island.

IT is proposed to consider the means through which the rules presented last year are to be applied and how the road supervision is to be selected, instructed and developed. The road supervision must point out the results of improper methods and the advantage derived from an observance of the rules. The inexperienced fireman must be shown the effects of good firing, that he may learn through his own observation that the methods outlined produce the best results. He can then be instructed concerning the abstract theories of combustion, and it should naturally follow that practical application of these principles will be unconsciously made.

It should be the aim of the organization to accomplish its purposes through appeal to the man's appreciation of his increased efficiency, to the intelligent completion of his task and to that feeling of self-respect which arises from a sense of personal capability. If these measures fail, obedience to the rules for the routine performance of the fireman's

task must be secured through the employment of such disciplinary measures as may be required. The effective instructor must have a knowledge of methods and processes involved, and he will be most efficient who has learned by the same means that he will employ in teaching others.

Knowledge of men is, of course, a prime essential. No leader can hope to succeed who is incapable of appreciating the problem introduced by the human element with which he has to deal. Coöperation must be secured or failure will result. The efficient instructor must be capable of overcoming his prejudices and conforming his ideas to progressive methods and appliances. This presupposes an active interest in the development of these devices that effect fuel economy and reasonable familiarity with the work of others in his field.

A man occupying any supervising position must be of high moral character, for, no matter what his other qualifications may be, if he is immoral—if his time outside regular working hours is devoted to intemperance or to other vices that are the accompaniment of late hours and bad habits—his condition mentally and physically will fail to meet the standard of efficiency demanded of a high-grade organization and he will not command the respect of the men, which is essential to his success. The final selection must be governed by: Physical fitness; personal character; practical experience; knowledge of underlying principles; ability to demonstrate; capacity to impart information, and ability to adapt himself to progressive methods and appliances.

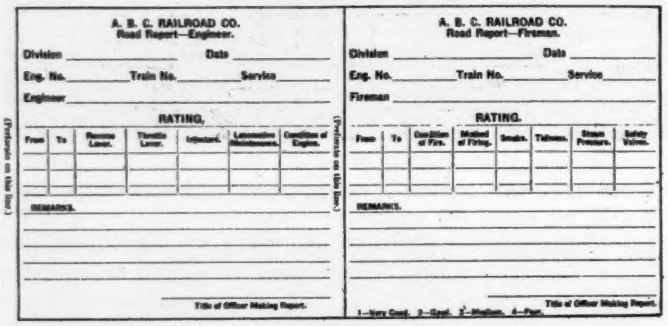


Fig. 1.—Proposed Road Trip Report

The replies to the committee's Circular of Inquiry showed that in general there were no definite methods of training, and this means that men are assigned to duty as road foremen or supervisors and left largely to their own resources, their work being judged by mechanical standards, to the exclusion of those features of economical operation which are daily becoming more pressing. The successful road foreman must produce reasonable economies in those expenditures for which he is properly responsible.

The requirements of effective organization demand that local officers shall know and study individual enginemen with a view to the vacancies which may occur, selecting for appointment those who have demonstrated by their work and their record that they are qualified for advancement.

Special effort is required in following up the candidate, in checking his work and judging his efficiency. For this purpose the road foreman's trip report blank appearing in Fig. 1 should be of assistance. This has been prepared in convenient form for the pocket with leaves in two sections, one for the engineer and one for the fireman, the pages being perforated to facilitate detachment so that they may be filed alphabetically. They will thus form a continuous and permanent record of the individual, from which his progress and relative standing may be judged.

The final selection will be governed by a knowledge of the men, gained through personal contact and through occasional staff meetings. The subjects for staff meetings should be announced in advance, so that opportunity may be given for preparation. One or more engineers or firemen should be requested to come prepared to discuss one of the subjects of the meeting, prospective candidates for promotion being occasionally designated. These meetings, being of general educational value, may be made to serve a useful purpose in training future road supervision through the opportunity offered for:

Presenting the aims and methods of the company with respect to the practical problems of economical locomotive operation.

A discussion of specific problems, with details of the sources of information bearing upon them and extracts therefrom.

The correction of individual weaknesses by indirect methods, in order that character and efficiency may be developed.

On large systems, appointments to minor road positions, in order to obtain knowledge of the capabilities of the prospective candidates for appointment, can, and are, usually made by placing the men on special duty. The first few trips should be made in company with the road foreman or his assistant in order to observe the methods used in directing firemen and enginemen and the means employed to secure the coöperation of the men. After a number of such trips and an appointment has been made, the new supervisor should be accompanied by his immediate superior, who should, at the proper time, advise and counsel his subordinate concerning his work on these trips, particularly his manner of dealing with the men.

Practical instruction should be accompanied by instruction in classes, which may include prospective candidates from two or more divisions, the respective road foremen acting as instructors. This work should include the special subjects that must subsequently be covered by the road foremen with the men, such as the details of the book on "Fuel Economy on Locomotives," the principles of combustion, locomotive design, the operation of special devices, care of the locomotive, and other related subjects. The head of the fuel department should be present at these instruction classes as often as possible.

On the larger roads the employment of an expert instructor on locomotive operation and fuel economy is recommended, who should come under the head of the motive-power department, and under his direction a special course should be provided for road foremen. The efficiency of such an instructor would probably be improved if he were provided with a car equipped for lecture purposes with a stereopticon and moving-picture machine, and such other apparatus as may be required to perform the simple experiments in combustion that are ordinarily used to illustrate the principles of good firing. On the smaller roads such instruction could be given by the head of the fuel department, the general road foreman of engines, or other officer of corresponding jurisdiction.

The instructions given by the chief instructor on "Locomotive Operation and Fuel Economy" should cover the road foremen, assistant road foremen, traveling enginemen, etc., and at these instruction meetings the policies and aims of the organization should be formulated and the opportunity taken for a general discussion of important topics, as, for example: Standards of divisional performance, and individual performance if possible; improved methods to be pursued; improvements of standards; methods of inducing employees to attain the standards; legitimate troubles experienced by the men, and demonstration of methods to be employed, especially devices that produce economy.

It is the duty of the head of the organization to establish the standards by which the results of the divisions are measured, and to do this successfully it is necessary to have complete and accurate statements as to what can be done. Where individual performance sheets are employed, they might properly form the basis for divisional statements prepared on a gross ton-mile basis, or in the case of passenger service on a straight mileage basis. In all cases the best previous record

must constitute the measure by which the results are gaged, and they must be interpreted with due regard for unusual conditions.

Every road foreman should be required to read at least one periodical monthly, dealing with railroad matters, and the officer in general charge should have a list of the magazines to which his subordinates subscribe. This will permit special attention to be drawn to an article of unusual value appearing in any particular paper. Interest will be stimulated if an opinion is occasionally asked on some article in a current number of a periodical, and, when occasion affords, single marked copies may be distributed with a similar request. By this means each man should increase his knowledge, keep up with the developments in his line and acquire new ideas for instruction work.

Whenever possible, the head of the fuel department should attend meetings of the associations, particularly the Traveling Engineers and Fuel Association, dealing with the subjects in which they are interested. He should be encouraged to take part in the proceedings, accept committee assignments and actively engage in the work of the associations. The advantages derived from attendance at association meetings require elaboration in a paper before a convention whose membership is wholly in sympathy with the work of related organizations.

Finally, the road work must be constantly reviewed. It is necessary that a check be kept upon the road supervision and upon the engine crews. The trip reports should be examined and questioned, that effort may be stimulated and efficiency increased. To successfully effect the desired fuel economies, it is necessary that confidence and enthusiasm be developed, and this must be obtained through the influence of the general officers and the local supervision.

SMOKE PREVENTION

In connection with the problem of smoke prevention, the committee directs attention to the report of the committee of the Chicago Association of Commerce, on "Smoke Abatement and Electrification." The investigations conducted by this committee were continued over a period of more than four years and reduced the subject to a scientific basis, where the influence of locomotive operation upon smoke emission may be judged in its true proportion. There is given below a table abstracted from the report, indicating the various classes of service responsible for air pollution:

RESPONSIBILITY OF EACH SERVICE FOR SMOKE POLLUTION WITHIN CHICAGO, ON PERCENTAGE BASIS.

	Visible Smoke, Per Cent	Solids of Smoke, Per Cent	Total of Smoke, Per Cent	Gaseous Carbon, Per Cent	Gaseous Sulphur, Per Cent
Steam locomotives	22.06	7.47	10.31	10.11	18.22
Steam vessels	0.74	0.33	0.60	0,55	0.45
High-pressure steam stationary power and heating plants	44.49	19.34	44.96	40.68	53.70
Low-pressure steam and other stationery heating plants	3.93	8.60	23.00	23.06	19.73
Gas and Coke plants	0.15	.....	.....	.....	.....
Furnaces for metallurgical, manufacturing and other processes	28.63	64.26	21.13	25.60	7.90

One-third of all air pollution is due to dirt other than that of combustion. These percentages refer to the remaining two-thirds.

From this table it will be observed that steam locomotives contribute to:

	Per Cent
Visible smoke	22.06
Solid constituents of smoke	7.47
Gaseous constituents of smoke	10.31

The portion of the total visible smoke of Chicago which is chargeable to different locomotive services is interesting and is as follows:

	Per Cent
Yard	10.25
Road freight	2.01
Freight transfer	4.59
Passenger transfer	.19
Through passenger	2.07
Suburban passenger	1.54
Locomotives at locomotive terminals	1.41
Total for steam locomotives	22.06

The proportions, while applicable only to the city of Chicago, nevertheless indicate in a general way the relations existing at other large terminals.

William Schlafge, (Erie): I wish to make a correction in last year's report. In that report a table was presented showing certain ratios between heating surface, grate area, etc. The heading over the last two columns of this table should be corrected to read:

"Ratio firebox heating surface to total evaporative heating surface, per cent."

This appears on page 263 of the 1915 proceedings.

DISCUSSION

Harry Clewer (C. R. I. & P.): I do not think there has been a paper read or discussed at these conventions that is of any more importance than the question of the conservation of fuel. The organization on our road is practically the same as was brought out in the paper. We have not only followed the fuel from the locomotive tender until it was consumed on the grate, but we also have directed our attention to the conservation and the preparation of the fuel from the time it is taken from the mine up to the time that it is consumed on the grate. The results obtained through this campaign have been very gratifying. The road foremen of engines are included in the organization and our fuel inspectors supervise the preparation of the fuel at the mines, its passage through the chutes, its preparation on the tender of the locomotive, and its conservation by the engine men, and the results which we have obtained by this system of supervision have been very satisfactory.

C. E. Chambers (C. of N. J.): I think the committee ought to be complimented for the paper and the detail with which it has gone into the subect. If all of the suggestions laid down by the committee are followed out, there would be a great reduction in the amount of smoke from locomotives.

Harrington Emerson: The paper states: "Many men are ill fitted by temperament to occupy any supervisory position, and unfortunately this in many cases can be determined only after trial." Believing, as I do, after long experience and investigation that you can always determine in advance whether a man by temperament is fitted for a particular position, I regret that this statement should be made in the paper. Similarly under the qualifications are given first, physical fitness, then personal character, practical experience, and so on. The very first requirement ought to be adaptability for the job. That comes ahead of physical fitness, personal character or anything else.

Recently, simply to indicate the extent to which investigations along this line go, we were requested to find a man for a position in St. Louis in a certain line of business out there, and we checked over 360 applicants in one single afternoon, in order to be sure that we had that initial quality first. It, therefore, is not a thing that is so tremendously difficult when, as stated above, no expensive, nor long winded, you can turn down 350 men out of 360 as not having the initial characteristics needed for the job. After that came the other qualifications as to physical qualities, mental qualities, experience, all of which takes a good long time to ascertain.

T. H. Hawley (Erie): Our railroad has a staff consist-

ing of a superintendent of locomotive operation, supervisor of locomotive operation, and road foreman of engines, whose duty it is to observe the operation of the locomotives, the fireman, the engine men, and the methods of handling fuel. We also have a staff of fuel inspectors stationed at the different mines to make a selection of the fuel purchased for locomotives. A report is made by those different representatives on their respective divisions, on each locomotive they ride on and its operation in regard to fuel, also, any condition of a locomotive that would bring about trouble from smoke, steam failures or anything pertaining to the operation during the trip. We try to instruct our men from the time they are taken into the service. When the fireman is first employed he is given a book on good firing, and for his first year, he fills out a report indicating his knowledge of fuel and the operation of the locomotive. He usually continues his study for four years, each year making out his reports, and at the expiration of that time if he passes his examinations he is promoted to the position of engineer so that he may be used when called upon.

There was something said in the paper in regard to the stoker fired locomotive in reference to fuel consumption, and I believe there was something said about smoke. We find that it is just as necessary to watch the operation of the stoker, as well as it is the operation of the hand fired locomotive.

Dr. Angus Sinclair: A great waste of fuel still exists through inferior firing of locomotives. There have been great improvements made in that respect in years past, but I think that Mr. Schlafge deserves as much credit as anyone I know for the great improvements that have been made on the Erie with regard to firing. Bad firing, of course, results in smoke, which is a testimony to what is going on.

W. H. Bradley, (C. & N. W.): I regret to note that the paper has not touched upon one of the greatest points for the conservation of fuel. I would like to see incorporated in the paragraph reading "Whenever possible, the head of the fuel department should attend meetings of the Associations, particularly the travelling engineers and fuel Association," after the words "fuel department," the words "Division Superintendents," and Chief Train dispatchers," as I believe there is much to be learned by these officers in fuel economy.

F. F. Gaines (C. of Ga.): We have a regular system of having meetings of our road foremen with the different engineers periodically. They discuss everything that tends to fuel economy, bring to our attention any points that may better it, and we carry them out if we think them feasible. In burning oil just as much judgment and common sense must be used, and it must be watched just as closely as when shoveling by hand.

Mr. Trumbull: In regard to the qualifications specified for a supervisor, I judge that the order there given is not to be taken as the order in which prospective candidates are to be examined. Some might assume that "capacity to impart information" was of greater importance than "physical fitness," so I assume that is merely a catalog of qualifications, rather than an order to be followed in examining candidates.

G. H. Baker: This report completes a series of three reports that this committee has submitted to the Association, and they are almost inestimable in their value to the railroad interests of this country. The committee says that the "Fuel costs the railroads in excess of $170,000,000 annually, and its use must be conserved." I believe that is a very modest statement. This year, with heavy traffic, I have no doubt that the coal consumption is going up to $270,000,000. Every practical railroad man, every practical locomotive officer, every man who has run a locomotive a few years knows very well that the coal consumption of the locomotives, in their normal operation, can be influenced fully 25 per cent by the men in charge of the engines; by the engineer and the fireman co-operating and doing their work in just the right way, taking advantage of all the emergencies in service to reduce their labor and to save coal for the company. Assuming a fuel cost of $250,000,000 a year, or $600,000 a day, a 25 per cent saving will mean $150,000 a day. That is what can be done. To what field of endeavor can this association address itself in which there is more profit to the railroad companies than to bring about an improvement in the service which will save $150,000 a day for the railroad companies of North America? That is the size of this problem, and that is the importance of this report, and the importance of the work of this committee.

This year the report covers the field of educating the officers that are to conduct the fuel economy movement, the road foremen of engines, picking them out in advance, seeing that they understand the necessities of the work and are in harmony with the policies of the company in this matter. I am very glad that the committee has brought this matter out. Road foremen of engines have never been properly appreciated on North American railroads. Their possible value has never been brought out to the maximum. Tne field of greatest value on a railroad of a road foreman of engines is to obtain economies in the operation of the locomotive, but we all know how frequently these important officers are taken away from this work and sent by the trainmaster or the superintendent to do this, that or the other foolish and unnecessary thing. You may have a road foreman of engines who has charge may be of 100 locomotives and you are depending on him for the efficient service of these locomotives, and then you send him away from these locomotives. That is a very unwise thing to do. In the selection of men to be railroad foremen of locomotives, you must have a practical locomotive engineer—no other man can fill the position—you need the best engineer you have on the division for that purpose. Can you get him? Not generally. Why? In the first place, the compensation is not sufficient to get the best men. In order to get the best man who is available for the place you must almost invariably ask him to make a sacrifice in his earnings of a very considerable amount, maybe as much as $50 a month, or $600 a year. You take him from the exercise of his skill and knowledge on one engine and put him in charge of 100 engines, and ask him to do that work for less money.

I maintain that is not fair to the man and very bad for the finances of the road. You want to take a man who can earn $200 a month, or very nearly that, running an engine, and ask him to be a road foreman of engines for $100 a month or $150 a month. Because of this you do not get the man you want, and the difference between the possible savings in the case of the man you ought to have had and try to get, and cannot get, and the man you finally accept is not $600 a year for the company, it may be $6,000, it may be $60,000 less for the company, because you have had to accept an inferior man. The office of railroad foreman of engineers ought to be appreciated by the managements of the railroads. The office ought to pay well. The office ought to lead to promotions, In that way only can you get the best engineers on the railroads to become road foremen of engines and to give you most valuable possible service.

J. W. Anderson, (C. & N. W.): I agree with the remarks which Mr. Baker made in connection with the bad practice of taking our traveling foremen and putting them out on some different work from what they are supposed to do.

it interferes with their plans a great many times and takes them off some special work they are following up very closely. The superintendent or train dispatcher can assist a great deal in fuel economy; as much as the travelling engineer or any other man who comes in contact with that problem. They can save a great deal of fuel by helping the men out a great many times in getting over the road. Another important point is in connection with the delivery of the proper sizes of coal to the locomotives. In some cases coal is delivered in large chunks, and it is hard to break up. It requires extra work, and makes the fireman and engineer feel that the company is not doing the thing they should do to assist the men.

Harrington Emerson: Those who have been interested in fuel consumption have been exceedingly desirous of finding what railroads in the country were really making economic records, so that their methods could be studied and investigated. As the reports are usually made you cannot tell from the report whether a road is good on fuel consumption or whether it is poor. What is needed in these comparative reports is that the price of fuel as well as the quantity should be given, that these two elements should be kept separately—the qualitative element (the cost) and the quantitative element (the amount), because only then can you tell whether one road is a model to which we can all turn or whether it is simply fortunate in its low fuel cost, because fuel costs very little in that locality.

Wm. Schlafge: Mr. Emerson directed attention to the matter as to requirements and called particular attention to physical fitness. Possibly adaptability would be more fitting there, but from the point of view of the committee, physical fitness is thought to be the essential requirement, as a man who is not physically fit cannot very well perform to his capacity. The report also states: "Many men are ill-fitted by temperament to occupy any supervisory position, and, unfortunately, this in many cases can be determined only after trial, but it should be determined while the man is on probation and before appointment." This is, in a large measure, true, and many a good locomotive engineer has been spoiled by endeavoring to make a road foreman of engines out of him when he did not have the necessary qualifications. What the committee had in mind was to avoid these mistakes as much as possible by selecting the proper timber out of which to make road foremen of engines and supervisors along the lines of the suggestions indicated in the report.

Report of Committee on Locomotive Headlights

The Committee on Headlights has reported so fully on this subject in previous years and with the tests included in the 1914 report has gone into the matter so extensively that the members feel that it has been covered sufficiently in previous reports. As there have been no new conditions arising that have demanded the attention of the committee during the past year an extended report was not required and a short one has been made. The report, however, suggests a good reason for the continuance of the committee.

D. F. Crawford, general superintendent of motive power of the Pennsylvania Lines West of Pittsburgh, the chairman of the committee, has been active in matters pertaining to the use of high power headlights during all of the investigations carried out by the Master Mechanics' Association and has represented the railroads at hearings before the Interstate Commerce Commission. The other members of the committee are: F. A. Torrey, general superintendent of motive power, Chicago, Burlington & Quincy; H. T. Bentley, assistant superintendent of motive power, Chicago & North Western; W. H. Flynn, superintendent of motive power, Michigan Central; M. K. Barnum, superintendent of motive power, Baltimore & Ohio; W. O. Moody, mechanical engineer, Illinois Central; C. H. Rae, assistant superintendent of motive power, Louisville & Nashville.

D. F. Crawford, Chairman

SINCE the last convention the committee has not received any suggestions from members as to subjects in connection with the headlight requiring investigation or further tests, and as the committee felt that the subject was quite fully covered in its report submitted to the 1914 convention, the committee did not undertake any further tests or investigations.

In connection with the Locomotive Boiler Inspection Law the question as to the proper kind of headlight to be used on the locomotives in the United States was raised, and members of the committee met in conference with the Chief Inspector, Division of Locomotive Boiler Inspection, and appeared as witnesses before the Interstate Commerce Commission in their consideration of this subject, presenting in the conference and at the hearing the facts recorded in the committee's report made in 1914.

DISCUSSION

D. F. Crawford, (Chairman): Since the preparation of this report the Interstate Commerce Commission has made an order regarding the locomotive headlights, which I presume most of you have seen. It has been published in the *Daily Railway Age Gazette* (June 16, p. 1358). As all of you know, the subject of locomotive headlights, in fact, the entire matter of locomotive inspection, including the headlight subject, was handled before the Commission by representatives of the Special Committee on the Relation of Legislation to Railway Operation. Since the promulgation of the order of the Commission the committee referred to has not had an opportunity to take action in regard to it, but I am advised that a circular will be sent to the railways who are affiliated with the Special Committee, giving the advice of the gentlemen who had had to do with this subject, at a very early date. I would therefore suggest that we wait until such advise is received before having further discussion of the subject. In view of the order of the Commission, it has been suggested by Mr. Hodges, of the Special Committee, that this committee request that it be continued as it is quite probable some further questions may come up about it. Therefore, that portion of the committee's report I would like to amend, and make the suggestion that the committee be continued.

F. H. Clark, (B. & O.): I move that the committee be continued.

C. E. Chambers: I second the motion.

(The motion was put to vote and carried.)

Design and Maintenance of Locomotive Boilers

Although this is designated as a special committee it has been in existence for many years. In 1912 an extensive report was made on the construction and maintenance of locomotive boilers, the idea being to inform the members as to the methods and practices followed on the different roads.

The report in 1913 dealt entirely with the maintenance of boilers and was enthusiastically received on the floor of the convention. It is doubtful if a more complete or comprehensive treatise has ever appeared on the maintenance of locomotive boilers, before or since. No report was made in 1914, but in 1915 methods were presented of figuring stresses; these were adopted as recommended practice. These cover rules for longitudinal barrel seams and patches, longitudinal gusset braces and flat surfaces; and staybolts, radial stays and crown bar bolts. This year's report has to do with boiler ratios.

C. E. Fuller, Chairman

C. E. Fuller, superintendent motive power and machinery, Union Pacific, is chairman. The other members are A. W. Gibbs, chief mechanical engineer, Pennsylvania; D. R. MacBain, superintendent motive power, New York Central Lines West; M. K. Barnum, superintendent motive power, Baltimore & Ohio; R. E. Smith, general superintendent motive power, Atlantic Coast Line; C. B. Young, mechanical engineer, Chicago, Burlington & Quincy, and J. Snowden Bell.

LAST year a report was presented on methods of calculating stresses in locomotive boilers, which has since been adopted as Recommended Practice, bringing about for the first time a uniform and harmonious method of calculating the various stresses and safety factors on new locomotive boilers.

That there may be no misunderstanding as to the true intent of this work, the committee wishes to state that these formulas are obviously intended for the use in connection with designing new construction only, where there are no restrictions, and do not apply to existing boilers.

This year Circular *K* was issued, and replies received from 31 roads, which replies were tabulated and grouped for further study and analysis, the result of which the committee now presents for consideration.

The modern locomotive being called upon to maintain high speed, with heavy and increasing train loads, and to meet greater demands for steam, the design and maintenance of boilers would seem to take precedence over any other part of the locomotive. That locomotive designers are aware of this seems evident from many of the replies received to the circular of inquiry, and the various means by which a number of roads are endeavoring to meet these conditions.

The most generally adopted improvement in fireboxes appears to be the use of combustion chambers, either of the ordinary type or of special construction, having a bridge wall with air inlets. In some cases the adoption of combustion chambers has been due to a desire to avoid excessively long tubes, while others have considered that the construction is desirable from its being inducive to longer flame travel, increasing firebox temperatures on account of the more complete combustion obtained. The increase in the ratio of firebox volume and grate area is held to be beneficial, producing better steaming boilers, while the improved combustion has the effect of eliminating black smoke. It does not appear that the cost of maintenance and repairs with combustion chambers is greater than is the case with the ordinary construction, while the life of the tubes is greatly increased by their use.

There appears to be little experimental data on the relative evaporative performance of boilers with or without combustion chambers.

The firebox design being recognized as of paramount importance there has been a general trend toward wider water spaces, about 4½ to 5 in. for the sides and 5½ to 6 in. at the front, being representative practice. Firebox door flanges have been given considerable attention, the majority of opinion favoring flanging the sheets toward each other; the joint in many cases being welded, with beneficial results from the elimination of rivets with their tendency to collect mud. Some state that the welded method is cheaper than the riveted joint.

From the replies it is found that cross braces are used as a matter of necessity on Belpaire fireboxes and boilers with flattened surfaces, and to some extent on crown bar boilers.

In order to obtain proper bearing for flexible radial stays which are at a sharp angle with the wrapper sheet, one road reports having pressed out bosses in the sheet, while another road builds up bosses by autogenous welding. The results, giving sufficient full threads through the sheets for the bolts, have been very satisfactory.

Regarding venting the crown sheet in case of low water, two members report that on coal-burning locomotives they omit the button heads on four front transverse rows of stays. Another member reports omitting button heads on the sixth, seventh, eighth and ninth rows back from the back tube sheets for the same purpose. The majority, however, do not make any allowance for this contingency.

Regarding the relative value of firebox and tube heating surface, there appears to be little data derived from tests. However, the accepted value assigned to firebox and tubes respectively, averages about 6 to 1, with special designs of firebox claiming a ratio as high as 12 to 1. The most effective ratio of firebox volume to grate area is indicated by the reports to be approximately from 5.5 or 6 to 1 for bituminous coal, and 4.5 or 4.85 to 1 for anthracite coal.

The use of long tubes is not favored, for, while the total evaporative capacity of the boiler may be increased by their use, the rate of evaporation per unit area of heating surface is lower, and discounts the theoretical increase in capacity. In this connection tests show conclusively that there is a great variation in the evaporation value of the boiler tube, about one-half of the heat being transmitted in the first quarter of the tube length. It appears that a proportion of tube length to diameter of 100 times the inside diameter is most satisfactory. Longer tubes do not require any greater spacing than reasonably short tubes.

The ratio of superheating surface to total saturated heating surface seems to vary from .198 to .29, the average for modern power being about .27 to .29 for boilers with combustion chambers and .20 to .22 for boilers without combustion chambers.

In a general way it may be deduced that in modern practice the built-up type of dome is being generally abandoned in favor of one-piece pressed-steel domes. In regard to the elimination of boiler seams, no general effort has been made, although one member reports satisfactory results from combining the throat sheet and the bottom half of the last course. In almost all cases firebox sheets, as well as wrapper sheets, are made in one piece. There does not appear to be any development along the lines of welding circumferential seams.

The use of cylinder volume as a basis in designing locomotive boilers, as outlined by this association in the Proceedings of 1897, has, with the development of new and larger types of locomotives and superheaters, proved unsatisfactory, and the committee is of the opinion that better results are obtainable from ratios based on cylinder horsepower.

The most interesting feature brought out by the committee in connection with boiler maintenance is the wide adoption of autogenous welding. The welding of tubes into tube sheets, of firebox seams, and the application of patches varying in size from small crack and pitting repair plates to half side sheets and backheads, marks an economical means of handling what has heretofore been a difficult and expensive problem. Both electric and acetylene welding processes have been used.

Firebox seams have been welded successfully, one member reporting 14 engines by the electric process, while another member reports 3 engines with all seams welded by the acetylene process. Several roads report having side sheet seams welded, with little or no trouble experienced. Occasionally it has been necessary to re-weld a seam, because of opening up.

The autogenous processes of welding have recently been used to quite an extent for patching in fireboxes. Some of the replies indicate that welding can be done at about 40 per cent of the cost of riveting; others report very little difference in cost. The methods of patching are still an experiment on most roads; others are reporting satisfactory results.

The practice of welding cracks in the knuckle of the tube sheet is quite extensively used, in most cases the welding being done on both sides of the sheet. Two members cut out the crack and weld in a patch, but in the majority of cases the crack is filled up without patching. While some roads report welding in half side sheets and half back heads, with satisfactory results, the practice has not yet become general. One member reports welding brick arch studs on the side sheets of the firebox, with success, but no welding-in of arch tubes has been reported.

The methods of safe-ending superheater flues are rather uniform, the usual way being to cut off the flue at the small end, scarf, apply the safe end, and weld in a flue-welding machine. A few members report that they have welded safe ends by the electric or oxy-acetylene process. In this method, after scarfing, the flue and safe end are separated about ⅛ in. and the opening filled up, rotating the flue during the process.

It seems to be accepted practice to avoid the use of more than one weld at a time in a superheater flue, which is accomplished by increasing the length of safe ends in successive applications, the old weld being cut off and a longer safe end used. Few roads weld safe ends to the enlarged portion of the flues. Results are in most cases reported as being satisfactory.

The usual practice in setting tubes appears to be, for the back end, to insert a copper ferrule in the hole, then roll, expand and bead the tube, after which the joint is cleaned and welded lightly on the edge of the bead. One member reports that copper ferrules are not used, nor the tube beaded, but welded in by the electric process, which is indicated to be the most generally used in this class of work. Tubes in the front tube sheet are not welded, but rolled, and about ten per cent beaded.

On engines having cylinders smaller than 20 in. diameter, it has not as a rule been considered advisable to apply superheaters.

In view of the development of the locomotive, it is our opinion that the ratios of 1897, being unsuitable, should be superseded by a method of calculation which will meet the variable conditions imposed by modern practice.

The reports indicate a wide departure from the Recommended Practice of 1897. Ratio of grate area in square feet to volume of two cylinders in cubic feet, for simple passenger or freight locomotives, should not be less than:

4 for large anthracite coal.
9 for small anthracite coal.
3 for bituminous coal.

From the replies received, for modern power these ratios have been increased 23 per cent.

The ratio of heating surface in square feet to grate area in square feet, for simple passenger and freight locomotives, should not be less than:

40 for large anthracite coal.
20 for small anthracite coal.
60 for bituminous coal.

From the replies received, for modern power these ratios have been increased 28 per cent.

The ratio of heating surface in square feet to volume of two cylinders in cubic feet, for simple passenger or freight locomotives, shoud not be less than:

180 for large anthracite coal.
200 for small anthracite coal.
200 for bituminous coal.

From the replies received, these ratios for modern power have been increased 34 per cent.

The committee, therefore, submits for adoption as Recommended Practice the following ratios based on cylinder horsepower:

D Diameter of cylinder.
P Boiler pressure.
A Area one cylinder diameter.
H-p. Horsepower.
TP Tractive effort.
d Diameter of drivers.
S Stroke in inches.

(1) From weight limitation on drivers, and from service, type, etc., obtain the required tractive effort.

(2) From tractive effort, boiler pressure, stroke and size of drivers obtain diameter of cylinder.

$$D = \sqrt{\frac{TP \times d}{.85 \times P \times S}}$$

H-p. = .02120 × P × A—saturated steam.
H-p. = .02290 × P × A—superheated steam.

Maximum horsepower assumed to be reached at the following piston speeds:

Saturated steam ...... 700 ft. per minute.
Superheated steam .... 1000 ft. per minute.

The following figures are based on reports from various testing plants and road tests made under different conditions, and are liberal and can be more than met under favorable conditions:

(3) Estimate total steam per hour from:
H-p. × 27.0—saturated steam.
H-p. × 20.8—superheated steam.
(4) Estimate total coal per hour from:
H-p. × 4.00 lb.—saturated steam.
H-p. × 3.25 lb.—superheated steam,

based on coal containing 14,000 B. t. u. per pound, using a percentage factor for poorer or better grades of coal.

(5) Estimate size of grate from total coal divided by 120, or

$$\text{Grate area} = \frac{\text{H-p.}}{30} \text{ for saturated steam.}$$

$$\text{Grate area} = \frac{\text{H-p.}}{36.9} \text{ for superheated steam.}$$

(6) Estimate the evaporation of the firebox, including combustion chamber and arch tubes, if used:

Sq. ft. firebox heating surface $\times$ 55 = evaporation in lb. per hr.

(7) Subtract (6) from (3) to obtain the tube and flue evaporation required. Base the evaporation on 10 lb. water per hr. per sq. ft.

(8) To obtain percentage of boiler, divide total pounds of steam the proposed boiler will evaporate by these formulas by pounds of steam required.

(9) The ratio of firebox volume to grate area should be about 5.5 or 6 to 1, for bituminous coal; 4.5 or 4.85 to 1, for anthracite coal.

The ratio of length to diameter for tubes should be about 100 to 1 $\times$ internal diameter, which for 2-in. tubes would give a length of about 16 ft. and for 2¼ in. tubes about 18 ft.

The ratio of superheating surface to total saturated heating surface should be, without combustion chamber, about .22, and with combustion chamber about .29.

The methods of calculating stresses in locomotive boilers, adopted as Recomended Practice last year, with the ratios submitted in this report, will place in the hands of the members a basis for locomotive boiler design which, meeting all modern conditions, will doubtless have the effect of improving the present methods.

The committee has been greatly impressed by the possibilities of the processes of autogenous welding for boiler maintenance and offers as a suggestion that a committee of the Association be appointed for the purpose of assembling and analyzing all available information on this important subject, with a view to arriving at standard methods of using the processes, and to develop further the present largely experimental work along this line.

DISCUSSION

Lawford H. Fry (Standard Steel Works): I understand from the report that the ratio of flue heating surface to firebox heating surface is given as averaging about 6 to 1. This seems rather a low figure. For example, a modern locomotive with 300 sq. ft. of firebox surface would have on this basis 1,800 sq. ft. of flue surface, or only 2,100 sq. ft. total heating surface. This is too small for a modern locomotive. The ratio of flue surface to firebox surface should be about 10 to 1. I thoroughly agree with the recommendation of the committee that the calculations should not be based on cylinder volume, but on cylinder horse power. There are so many special conditions nowadays which require special proportions of cylinders that the volume is a very much less satisfactory basis for calculation than the cylinder horse power.

C. D. Young (Penna. Lines): As Mr. Fry has mentioned, we should have a higher ratio of firebox heating surface to the tube heating surface, although the volume is probably of more importance than the ratio to the surfaces alone. In laying out the design of most boilers we have to start at the mud ring, and we are limited at the top by our clearances. In designing first the flue sheet and the throat sheet, in order to get proper clearance, it seems to me it is most essential that the designer should give due consideration to the distances which he has to work in between the top of the grates and the under side of his arch at the throat sheet. If this important dimension is neglected, regardless of what the ratios may be, it will be a very difficult locomotive to fire. I believe that in any design not less than 18 in. should be provided between the top of the grates and the under side of the arch at this point, in order to readily take care of the ash that accumulates there and in order to give the fireman a chance to use the entire grate area when it comes to working to the full capacity of the engine. This dimension having been established by this height, and being limited by your walls, it almost automatically takes care of how large the combustion chamber can be, or how many tubes you can place in the boiler. If you follow the recommendation of the committee regarding the tube length to its internal diameter, with which I quite agree, this also automatically establishes what the ratio between the firebox heating surface and the tube heating surface will be. It seems to me that some mention should have been made regarding what minimum clearance should be allowed under the arch in order to produce good firing conditions, as I believe that is where you should start the individual boiler design. In the operation of our testing plant at Altoona, we have developed one very interesting feature in connection with boiler design with particular reference to the length of superheater units. The standard practice of the Locomotive Superheat Company is to place the back end of the units 24 in. ahead of the back tube sheet, the thought being that this was the minimum distance you could go to the firebox and safely prevent the burning out of units.

In the combustion chamber type of locomotives, as compared with the standard boilers, we found that the temperature at the location of a superheating unit was dependent almost entirely upon the dimension from the center of the firebox to the back end of the unit; in other words, if you have a combustion chamber boiler you can safely move the units further back with very little increase in heating surfaces and with a much higher superheat for that heating surface. This is reflected in the increased boiler capacity, in that the water rate is materially reduced by the increase in superheat, and on freight locomotives that increase is not sufficiently great to give trouble from lubrication. So I believe that on combustion chamber boilers, where the combustion chambers run from 18 to 36 in., that it is perfectly safe and it is quite good practice to bring the units back to the flue sheets as close as you can get them and still avoid the choking where the large flue is swadged down. This practice has been made standard on our modern Mikado engines, which were originally turned out with the superheater units 24 in. from the tube sheet.

F. F. Gaines (C. of Ga.): I want to confirm what Mr. Young has just said. I have made some experiments along those lines myself. We had some engines with combustion chambers and the regular standard location of the superheater unit, and afterwards we added to that by electric welding and brought them out as far as we could and we found that we got very much better results all the way around. There is another question relative to welding. We have made some experiments along these lines. We have welded boiler seams in the laboratory and in every case, after pulling those pieces, they would uniformly break outside of the weld at a tensile strength that was at least normal to the plane. The committee says they have no data relative to the evaporation performance of boilers, with or without combustion chambers. We have some figures which show that there is about a 10 per cent difference. Of course, that might apply to all types of engines, but it did apply to this particular type engine.

William Elmer (Penna. Lines): Regarding the paragraph to which Mr. Fry called attention, I got a different view on the subject from the one which he apparently, and perhaps other members of the association, have received. Mr. Fry thought that the firebox heating surface ought to be about one-sixth of the total heating surface. My understanding was that that was meant to indicate that the firebox evaporates six times as much water as the tubes.

Mr. Fuller (chairman): Mr. Elmer is correct. There are one or two corrections to be made in this report in reference to maintenance, and it is our intention to correct it before it is printed, especially in speaking about the steam and water not having the pounds where they should appear.

Report on Superheater Locomotives

The work of the Committee during the past year consisted of investigating the cost of maintenance of superheater locomotives, the performance of slide valves on locomotives of this type, and various other details in locomotive construction which may be found to be influenced by the use of superheated steam. The committee also has under consideration the study of the most economical boiler pressure for superheater locomotives, results obtained from different types of drifting valves, and the nature of the steel which should be used for unit bolts in the superheater headers. The committee received replies to their inquiries from railroads representing approximately 55,000 locomotives.

W. J. Tollerton, general mechanical superintendent of the Rock Island Lines, is chairman of the committee.

The other members are: H. W. Coddington, engineer of tests, Norfolk & Western; C. H. Hogan, assistant superintendent motive power, New York Central; R. W. Bell, general superintendent motive power, Illinois Central; T. Roope, superintendent motive power, Chicago, Burlington & Quincy; W. C. A. Henry, superintendent motive power, Pennsylvania Lines West; E. W. Pratt, assistant superintendent motive power, Chicago & North Western, and G. M. Basford, president, Locomotive Feed Water Heater Company.

As of January 1, 1916, there were 15,666 superheater locomotives in service in the United States and Canada, practically all of the fire-tube type, as follows:

Superheaters applied at time of construction of locomotive....	9,900
Superheaters applied to locomotives already in service.......	5,766
	15,666

With the exception of one prominent railroad, very few locomotives originally equipped with slide valves, have been changed to piston valve and had superheaters applied. With the exception of 142 Mallet locomotives, equipped with superheaters, having slide valves on the low pressure cylinders, very few superheater locomotives are equipped with slide valves. The railroad on which these Mallet locomotives are operating is experimenting with a view of applying piston valves. Therefore, the committee does not feel this subject can be thoroughly discussed at this time.

Of the railroads reporting, 99 per cent of the superheater locomotives were equipped with brick arches. The use of brick arches is specially recommended on superheater locomotives, where practicable, as it causes more perfect combustion, better distribution of heat in the fire-box, protects the flues and sheets and effects a reduction in smoke and sparks and cinders in the flues and front end. In extremely bad water districts, the application of arches should be determined by local conditions.

It is recommended that a program be adopted for the application of superheaters to existing power on a monthly schedule. This will enable the railroads to place orders in advance for the necessary material and thereby avoid delay to locomotives undergoing repairs, awaiting superheater material.

There is a decided difference of opinion as to the advisability of equipping switching locomotives with superheaters. Some railroads maintain the same relative economies are effected through superheating switching locomotives as are obtained by superheating road locomotives. Other railroads will not give consideration to superheating switching locomotives until all available road locomotives have been equipped, owing to the greater returns to be obtained. The committee commends the application of superheaters to switching locomotives, but considers their application to road locomotives as being generally of greater importance.

It is felt that no set rule can be formulated covering the application of superheaters to existing locomotives, as age, general condition, capacity and further service to be secured must govern. Several railroads reported having superheated locomotives ten to fifteen years old.

From replies received, it is apparent that the superheater will be specified on all road locomotives and many switching locomotives purchased in the future.

The return tube, top header, double loop superheater is the type most generally used.

In view of the many complete reports which have already been rendered on tests covering the economies effected through the application of superheater, and superheater and brick arch, the committee does not believe it necessary to publish further data in this report. However, on a conservative basis, it is felt that an economy of 15 to 25 per cent in fuel and 20 to 30 per cent in water consumption can be expected in every-day operation through use of the superheater and brick arch. Numerous tests have shown greater economies.

On a number of railroads the application of superheaters has reduced the time of freight trains on the road ten to fifteen per cent and eliminated one stop for coal and two stops for water over one freight engine division.

It is generally felt by all, and proved by some careful comparative tests, that the cost of repairs (Maintenance of Equipment) is greater for locomotives equipped with the superheater and brick arch. However, for the railroad as a whole, the reductions effected in the cost of coal and water and the increased general efficiency (Conducting Transportation), offset this many times over.

In general, no changes are necessary in the front end arrangement due to the application of a superheater, aside from those made on account of the superheater elements, header and damper.

Replies received indicate no great variation in the size of the exhaust nozzle tip between the saturated and the superheated steam locomotives of the same general characteristics.

The committee feels that the best results will be obtained in operating superheater locomotives by carrying about two gages of water, with full throttle on short cut-offs, so far as operating conditions will permit. The enginemen should also be required to crack the throttle when drifting.

LUBRICATION OF SUPERHEATER LOCOMOTIVES

The investigation develops that the majority of superheater locomotives are equipped with hydrostatic lubricators without booster, although a considerable number of railroads are using the hydrostatic lubricator with the booster attachment. The booster is of value if the hydrostatic lubricator has a restricted equalizing passage. If the hydrostatic lubri-

cator is designed with the proper size equalizing passage, the booster attachment is unnecessary, as its principal function is to compensate for the restricting equalizing passage. The use of the force feed lubricator is very limited, but a number of railroads are experimenting with this type at the present time.

The use of an independent feed for lubricating the cylinders is limited. It is the opinion of the committee that this is unnecessary and should be discontinued, as it is very questionable if any benefits are being derived therefrom.

The majority of railroads are now using a superheat oil for the lubrication of superheater locomotives. They state that it does not carbonize and better results are obtained.

It generally has been necessary to increase the valve oil allowance 20 to 25 per cent for the superheater locomotives over the allowance for saturated locomotives of similar type and size. However, this does not apply in the same proportions to bad water districts, where superheating has reduced the foaming and eliminated water being carried over into the cylinder, in which cases no increase in oil allowance has been necessary.

Various methods have been tried for the use of graphite on superheater locomotives, but the replies received indicate the majority are not using graphite.

Trouble has been experienced with carbonization of oil in valve spools and piston heads, and to a lesser degree in the air pumps. In the valve spools and piston heads, this has been remedied by decreasing the amount of oxygen drawn into the cylinder, by drifting with a partially open throttle or drifting valve. The use of superheat oil will also decrease the trouble. The application of superheaters to locomotives equipped with slide valves has been so limited, the committee does not feel warranted in discussing the system of lubrication for that type of locomotive at this time.

RELIEF, BY-PASS AND DRIFTING VALVES

Vacuum relief valves are generally used, although there is some question as to what benefit, if any, results.

The majority of replies received indicate that the by-pass valve is not in general use on superheater locomotives. These have only been advocated for large-cylindered locomotives, to take care of the high compression in the cylinders.

A number of railroads are now using, and others are experimenting with, drifting valves, either manually or automatically operated. When the throttle valve is used on superheated steam locomotives when drifting, superheated steam is used. When the drifting valve is used, either manually or automatically operated, saturated steam is used.

Generally, no distinction is made between large and small locomotives in passenger and freight service as to size of drifting valve or steam connections, and for the sake of standardization such practice is desirable.

When locomotives are not equipped with by-pass, automatic or manually operated drifting valve, or other drifting valve operated from the cab, the throttle should be cracked while drifting a sufficient amount to prevent the admission of air. This will decrease carbonization.

Very little experimenting has been done in the application of pyrometers to locomotives, outside of special tests, but the committee believes it is desirable to make tests from time to time to ascertain the degree of efficiency being obtained. In view of the initial cost, it is felt that portable instruments would answer the requirements, a certain number for each division, to be transferred from one locomotive to another. The pyrometers should be adjusted at regular intervals, in order to obtain accurate readings.

MAINTENANCE

Some difficulty has been experienced due to superheater headers cracking, units leaking and packing melting. In general, however, the trouble has not been serious from these sources. There are no comparable data available as regards engine failures as between superheated and saturated steam locomotives. Better design or foundry practice is recommended as a remedy for the trouble with the headers and better workmanship for the units. The standard set of tools as recommended by the superheater manufacturers is recommended for adoption as standard for the care and maintenance of superheaters.

At present there are a number of railroads which have no printed instructions for roundhouse forces, back shop employees and enginemen on the operation and maintenance of superheater locomotives. In order that the greatest efficiency may be obtained, it is very necessary that all employees be fully conversant with these features. For the guidance of roundhouse and back shop employees, a standard practice card, embodying the instructions as recommended by the superheater manufacturers, should be issued.

A number of railroads are welding all flues in the back flue sheet successfully, the welding being done with the ordinary types of welding equipment.

With the exception of one prominent railroad, all railroads reporting are using superheater dampers in the front end satisfactorily.

The investigation develops that a number of railroads have had more cracked cylinders and saddles with superheater locomotives. They have now adopted outside steam pipes, which involved changes in the design of the cylinders.

DISCUSSION

D. R. MacBain, (N. Y. C.): In the jurisdiction over which I have charge we have about 650 locomotives equipped with superheaters, all of which are of the Schmidt type, but one, which is a Vaughan-Horsey. Referring to that part of the paper which has to do with lubricants, our cost for lubricants has come down steadily from about $2.70 per thousand miles to about $2.20. The average tractive effort of the locomotives on our line is about 36,600 lb. We have made substantial reductions in the cost of maintenance of locomotives equipped with superheaters on both the mile unit and the ton-mile unit. At the present time, running on that high tractive force, it has cost less than 8 cents per mile. We have watched the economies, and have made some very exhaustive tests, which show a clean cut 20 per cent saving on fuel. We are the first road in the United States that applied the superheater to a switch engine. One of the reasons which prompted us to do this was the constant complaints that we received from patrons of the road in having their clothes soiled in going to and from the trains at the stations. We thought the application of the superheater would, in a measure, cut out that nuisance of splattering water from the smokestack in making quick movements. Tests were made and we found an actual saving in fuel on that engine of nearly 30 per cent.

We never have claimed that we got any high degree of superheat on a switching locomotive, especially when making short movements, but this is what we did find: on three different tests we found that even in the summer time, say for the month of September, we had a drop of approximately 25 per cent in the steam temperature on the saturated switchers from the time it left the boiler until it entered the cylinder. With the superheater switching locomotive, we took up that 25 per cent, or in other words we were able to maintain on that slow moving, short work switch engine, just about boiler temperature in the cylinder.

I am very well convinced that no person need hesitate to put a superheater on a slide valve switching engine that is going to do short work, but if that engine is going to make trips of 6, 8 or 10 miles, I would not recommend it.

C. F. Giles, (L. & N.): With respect to the use of a drifting valve, it is stated, "The engineer should also be required to crack the throttle when drifting." We have endeavored to have our men carry out those instructions, and we found

it was a very difficult matter to get them to use a cracked throttle in drifting down a long run, because there is no telling just how wide the throttle is kept open. We later on introduced an intercepting valve in the throttle, with the expectation that it would be cracked and kept open when the main throttle was closed off, but this did not prove entirely satisfactory. Besides, the steam that is taken into the cylinder through the superheat units, regardless of whether it is drifting or working steam, is naturally superheated. You do not get anything like as good results from the introduction of superheat steam in drifting as you do saturated steam.

Last summer we applied an automatic drifting valve gotten up by a man in Mobile. The valve is connected to a pipe direct from the dome, which provides saturated steam to the cylinders while drifting, a branch pipe running from each side of this drifting valve to the steam chest. That valve has been in service since October on one engine, and for several months on two other engines. It has proven highly satisfactory. On a recent trip south I had the steam chests and cylinders on the engine on which the drifting valve had been applied since October removed, and found that they were lubricated equally as satisfactorily as any saturated engine that I have examined, and this valve has practically put a stop to all of our packing troubles. On that engine it has not only prevented the accumulation of carbon, but it has practically eliminated the carbon already accumulated.

I thought it would be of interest to the Association to have some information on that subject, and I feel that we would be justified, with the experiments that we have thus far made, in applying the valves to all engines on which we have had such trouble. In connection with the application of superheaters to switching locomotives, we built eight switching locomotives something over a year ago, weighing 220,000 lb., with 47,000 tractive effort, carrying 170,000 lb. steam. Those engines have proven highly satisfactory. They have not only very materially reduced the fuel consumption, compared to very large lighter locomotives of the saturated type, but they have aided very materially in reducing the complaint in regard to smoke. The first use that we made of those engines was at our terminals in Nashville, right in the center of the city, where we have had more complaint than from any other town or city in which we operate. There has been absolutely no complaint whatever from smoke nuisance in connection with those engines. They are equipped with brick arches, and a test made of the first engine has shown a marvelous saving in fuel as compared with a switch of a very much lighter tractive effort of the saturated type.

I. B. Thomas (Penna. Lines): The Committee mentions the welding of flues. We have kept a record of flue caulkings. In 1912 we were averaging about 125,000 flue caulkings a month on 540 locomotives, but with the flues welded on about 75 per cent. of the locomotives, the flues welded dropped to less than 10,000 a month.

C. A. Seley (American Flexible Bolt Co.): I know of two roads in this country that seem to be successfully operating superheater engines equipped with slide valves. I think it would be of interest to the Association if the representatives of those roads would tell us what they have done.

F. C. Pickard (D. L. & W.): We have fifteen locomotives that unfortunately in their original design were very much over-cylindered. These engines were used in road service with two firemen. In order to rehabilitate the engines we applied superheaters and brick arches. We are now using them successfully over a 119-mile division, and on the division which I have charge of I have 15 of them in helper service on a 17-mile hill and a 22-mile hill. In the introduction of the superheater we cut the steam pressure from 185 to 175 lb. For lubrication we use a five-feed lubricator, and run the pipe which leads to the cylinder to the end of the valve bridges, drilling into these bridges and clear across them. We cape-chiseled a groove across the cross bridge, and with the introduction of the oil in that way we have been successful in keeping the engines going. At first we had considerable trouble on the hills where they drifted down 17 miles, by not keeping their throttle a little "cracked," but that was a matter of education of the men.

C. E. Chambers, (C. of N. J.): I would like to ask why they cut the steam pressure to 175 lbs.; whether it was because of their being over-cylindered. It is our practice to weld all flues in superheater engines. We find it cuts down trouble in the way of calking flues to practically nothing, and we gain a great deal of service by so doing. We have had some trouble with lubrication and I have just recently found one of the troubles. It had been our practice for some time in fitting up valve rings to give them a little too much clearance in the bull ring; a great deal of oil was blowing by in the exhaust and we lost the benefit of it. We made an experiment on one engine in particular, and got a decided gain in lubrication.

J. H. McGoff, (A., T. & S. F.): We are operating 20 or 25 engines of the Mikado type, in freight service, and perhaps that many passenger engines, very successfully. As far as lubrication is concerned we do not have any trouble whatever. We use the three-feed lubricator. We do not have any trouble with the flues; they are not welded but are beaded over.

E. W. Pratt, (C. & N. W.): I spent a very profitable day last month at Cleveland, at the Boilermakers' Convention. There was something that came to my notice there that I thought I would mention here. On the Chicago & North Western we have done a great deal of welding of flues. Some of it is successful, but in bad water conditions some of the welding of small flues has not been successful. The point that was called to my attention there was that several railroads, in an experimental way, were electrically welding their flues at the firebox end with water in the boiler. At first it seemed as if it was a singular thing to do, but when we consider the effort that is being made in all classes of welding to reduce the amount of expansion from heat, and later contraction from cooling, there ought to be a good deal of experimentation made by the members of this association in not only welding flues, but perhaps welding other parts of the fireboxes. It certainly seems to me more ideal to have water on the entire water surface.

John Purcell, (A., T. & S. F.): We have got over 200 superheater engines; some are simple and some compound, ranging in tractive power from 30,000 to 60,000 lb. We have had very good results on fuel saving, but we have had considerable trouble with cylinder packing wearing out a little more rapidly than we think it ought to. We found that the oil carbonized. We tried out quite a number of valves to admit the steam into the cylinders, but so far we have not been very successful. We tried some two years ago to take out the relief valves on one of the balanced compound engines, with a superheater in it, and ran that engine for possibly two years with the relief valves out. We made periodical examinations of the packing, and we found that in the engine with the relief valve out entirely, the packing ran twice as long as it did with the relief valves in. I believe there is where a good deal of trouble comes in, in the carbonization of the oils.

We found at quite a number of our roundhouses, after we adopted superheaters, that we did not get the results that we thought we ought to; engines would come in and would be reported not steaming. We would test the steam pipes, make an examination, and we could not find anything wrong with them, but later we found that they were not keeping the flues clean; in fact we found one or two engines in which the larger superheater tubes were practically solid. After we got instructions out on that we got very much better results.

While we have not adopted a policy of equipping so many engines per month, it was our intention to equip all of our locomotives that range in tractive power from 30,000 lb. up. We designed all of our cylinder packing for engines that we intended to superheat.

D. R. MacBain, (N. Y. C.): When I referred to the average tractive power of the engines on the Lines West I referred to the average tractive power of all the engines, not the superheater engines. The average tractive power of the engines equipped with superheaters is much higher than the figure I gave.

I forgot to say, too, that we use no relief valve, nor bypass valve; it is shut up tight. We have but one oil inlet to the cylinder, and wherever it is practical to do so we put that right into the steam passage, whether it is the outside pipe or the passage down through the saddle.

H. C. Woodbridge, (B. R. & P.): About three years ago we tried a method by which we bathed the bottom of the face of the valve and seat with saturated steam, lubricated. We got a circulation between the seat and the valve face. We ran the engine using saturated steam for eleven months, testing it out as far as we could with a wide open throttle, and a short cutoff, for a long distance. We then applied a Schmidt superheater to that locomotive. Since the application the engine has made 35,000 miles, running during the past five or six months in pooled service, and in that service the engine was allowed one pint and three-quarters oil for a 107 mile run, although I do not think that is quite enough. We ran the engine in passenger service. (It is a 40,000 lb. tractive effort Consolidation engine.) We put it in passenger service to see if we could burn the valves up, and it performed very satisfactorily on the fastest trains that we have got, where it was necessary to run 53 or 54 miles an hour, which with a small wheel meant five revolutions a second a good deal of the time. We then applied the same scheme to an Atlantic type passenger locomotive, each of these engines carrying 200 lb. steam pressure. That engine has now made over 20,000 miles very successfully. We are applying the same scheme to a decapod pusher engine at present and from our experience we believe that so far as our railroad is concerned, we have solved the problem of operating the slide valve with high degree superheat.

I have been on both the freight and passenger engine when the throttle has been wide open for an hour. Last week I rode the engine on one of our regular trains, and we made a very successful run on a 17-mile hill, averaging better than one per cent. The throttle was open wide, and we made the 17 miles in 26 minutes. We had some Locomotive Superheater Company representatives on several trips of the Consolidation engine, and while we have not had a pyrometer on the engine, one of them said that he did not know how we could get any higher degree of superheat than we got in the service of those engines.

I know that some of my friends are thinking of the distortion of the slide valve under the high temperature. I think that the distortion of a properly designed slide valve will not be sufficient to cause any trouble, if it is properly lubricated, as we think we are properly lubricating them. We never heard a thing about distortion of slide valves until we began to put on superheaters, and I was very much surprised after I found a slight distortion in the valves which we were running with superheat, to find just as much distortion in the same character of valve with saturated steam. I could not measure the difference. In other words, after it had made 20,000 miles it was seven thousandths of an inch off the seat in the center, when it was cold; and yet the seat was perfectly smooth and had a high polish.

We intend to equip at least 60 other slide valves with superheater apparatus.

Mr. Chambers: We use the three feed lubricator entirely. We pipe into the steam passageway, into the saddle as far away from the steam passage as possible, and we do not experience any trouble to speak of, on moderate speed engines, but it is the engines that shut-off and drift from 80 to 85 m. p. h., down to a stop, or slow down, that give us the trouble.

C. A. Seley, (Amer. Flexible Bolt Co.): It seems to me that the question of lubrication on superheater engines has assumed undue importance. It seems to me to be of just as much importance to save a dollar in oil as it is a dollar in coal. The relative importance of the consumption of oil and the consumption of coal seems to me ought to be used in consideration of the result of the saving of coal.

H. T. Bentley, (C. & N. W.): One thing that is causing us more anxiety than anything else is the wear of bull rings and cylinder packing rings. I do not know whether any of the members here have got any mileage figures they can give us to show us what they are making with their cylinder packing rings, but it might be interesting if they have. Our biggest trouble is in cylinder packing wear and bull ring wear. I had a man in my office the other day who said that by the use of a forced feed lubricator a certain railroad in this country is getting from 60,000 to 65,000 miles for a cylinder packing ring. I thought that was a pretty good record, because we are not averaging more than 8,000 or 10,000 miles. We are just making some experiments with the forced feed lubricator. I am not very sure but what a good deal of our trouble is in our method of lubrication. I am going to send somebody over to Mr. MacBain's road to see how he reduces his cost of lubrication with superheater engines, and also the cost of locomotive repairs, because we cannot do it. We have put superheaters on engines that were originally designed for saturated engines, and we have not changed a single cylinder, and so far we are getting away with it, and I hope we will continue to do so.

C. D. Young, (Penna): There are a great many superheater locomotives equipped with high temperature superheat apparatus in use on the continent and in England, which have slide valves and operate very satisfactorily. There are two things that are generally practiced in combination with this application, however, which I think are quite essential. They generally use what they call a monkey valve, which is what we call a drifting valve, but in this case the engineer operates it. They use force-feed lubrication, and in combination with this they pipe to the base of the seat of the slide valve and take it through four or six ports, drilled in, and then grooved across the ports, so as to bring the oil up between the exhaust and the admission in the slide valve. In some cases they use phosphor bronze seats and valves, but I do not think that is as common a practice as using cast iron.

It seems to me with the operating conditions we have in this country, that unless there is very close supervision exercised over the operation of the locomotives the piston valve is the best solution for the superheater locomotive, taking into consideration the type of operatives we have and the type of roundhouse maintenance we have. If, on the other hand, it is necessary to use the slide valve with the superheater, I believe that can be accomplished here if the same precautions are exercised in the application and the operation of the valve as are exercised abroad. But my thought was that it should only be applied where you can expect good operation from the engine men and close supervision in the engine house.

The pyrometer for superheater locomotives is used in Germany, I believe, on all their locomotives. They consider it quite as essential for the good operation and firing of the engine as the steam gauge. I believe the same thing would hold true in this country if we could get a satisfactory pyrometer. We have experimented with all those produced, but they do not seem to meet the American practice or American maintenance, and therefore we are still operating with steam gauges. I think the principal value of the pyrometer

is that it gives the engineer a clear idea of what kind of a fire the fireman is putting into the box, whether it is uniform, thin bright fire, producing high superheat, or a green, heavy bank at the back of the firebox producing low superheat. If you will observe a locomotive fired with what is known as a bank fire, and place a pyrometer on the locomotive, you will find the superheat is sometimes as low as 90 or 100 deg. If you will break down the bank and brighten up the fire it will increase over 100 deg. in superheat, with no change in the operation except in the handling of the fire and the firing. If you will observe in connection with the same comparison between a heavy fire and a light bright fire the operation of the injector you will find with the heavy bank fire on a heavy pull you will be using two injectors, cut about half, perhaps three-quarters, and if you break down the heavy bank and get a bright fire and high superheat, the locomotive will go along at the same speed, hauling the same train with one injector on and only open a little more than when you had two injectors in operation, which proves to my mind that we should use pyrometers on all locomotives, if we could only get one that would work satisfactorily, and give us consistent service.

G. W. Wildin, (N. Y., N. H. & H.): The New Haven road is one of those roads that never has indulged in piston valve engines, and when I took charge of the mechanical department there was not a single piston valve engine on the railroad. Today the only piston valve engines on the road are those used in conjunction with superheaters. We did not take the trouble to find out whether or not we could operate slide valve engines with superheated steam, because in changing them over we found in the redesigning by the application of the superheater you gain considerable weight on the drivers that you can utilize in effective tractive effort. By the application of new cylinders with piston valves we are able to gain anywhere from five to ten per cent. in the tractive effort of the engines, which in any case will pay for changing the cylinders, considering that the locomotives will probably be in service fifteen or twenty years.

As regards the question of lubrication, I want to say that the entire trouble in this matter is up to the lubrication, particularly in connection with the lubrication of the packing. We made some tests with regard to certain lubricators, having one engine equipped with a graphite lubricator, and another engine with the ordinary construction of lubricator, both superheater engines. We got between 30,000 and 40,000 miles out of the packing, using the five feed lubricator.

As far as economy goes, if I could save 100 per cent. valve oil on the average, I could have approximately $30,000 a year on the New Haven Road. Five per cent. on coal saved would be $500,000 a year. I am willing to burn up five cents' worth of oil to save a dollar's worth of coal, and I imagine that every other road would be willing to do the same thing.

I have a combination on the New Haven Road which is giving me satisfactory results. I am free to say I do not know what part of the combination gives the results. We have drifting valves, we have piston valves, we have by-pass valves and we have the five-feed lubricator. I have been urged to take off the by-pass valve by the locomotive builders, so as to cheapen the engines. I have been urged to use a three-feed lubricator by the oil company, because we have a contract with them on the 1,000-mile basis. I do not want to break that combination. I am getting the results and I am very reluctant to make any change.

When we turned the first superheater engines out on the road, I put the road foreman of engines on to one of these engines to find out what the conditions of operation were. He advised me that in reducing speed, when it came to 15 m. p. h., there was a terrific pounding in the steam chest. I put a 60 lb. spring on top of the relief valve. When it goes down it stays there. Whatever steam accumulates exhausts in the steam chest, goes to the atmosphere, instead of forcing the steam chest valve back up on its seat.

S. L. Bean, (A., T. & S. F.): We have had one trouble which has not been mentioned here, and that is trouble with the packing of the bull rings. We have 20 engines burning oil. The smoke tubes are set in the usual way, but we usually had trouble in holding the tubes tight, and this trouble bothered us to such an extent that we resorted to the use of thimbles of ¼ in. thickness, and that of course robbed us of a few degrees of superheat, but it practically stopped our trouble. We recently thought we would take these thimbles out and try to operate without them. Our troubles returned to such an extent that the engine died on the road. These are large locomotives of the Santa Fe class. We are operating these locomotives where the grades are high for distances of 25 to 30 miles, 2.2 per cent grades, but with the small tubes there is no trouble.

C. B. Smith, (B. & M.): The Boston & Maine has been operating superheater locomotives for the past three years and we have a record of continuous use of packing rings between the general shoppings of the locomotives. We are using the Hunt-Spiller iron for packing rings in all locomotives. We are using superheater oil. We are using a type of drifting valve employing saturated steam. We do not have the trouble with the carbonization of oil in the cylinders, commonly experienced on at least a great many roads according to information which I have been able to gather from various sources. We always apply to the locomotives steam chests relief valves and by-pass valves, and although I am free to say there are a great many by-pass valves which are plugged and are inoperative, yet we have come to feel that it would be better to supply the locomotive with by-pass valves rather than to omit them until we are perfectly sure they can be omitted from the engine with safety.

C. E. Fuller: I ask the section of the packing rings and the style of the piston.

C. B. Smith: We use the solid type pistons, and the packing rings are ¾ in. by 1 in. by 13/16 in. deep. Two rings per head are used.

C. E. Fuller (U. P.): Mr. Smith's statement relative to the mileage of the packing rings is very interesting, but I think we will have to give consideration to the water conditions in this country as having a bearing on the use and life of the packing rings. We have all kinds of trouble with the packing rings in our country. We are using the Hunt-Spiller rings. We are experimenting now with what you might call a built-up piston. It is not a built-up piston in reality, but is on that principle, so as to get the Hunt-Spiller bull ring. It is a method of inserting the bull ring so that it is practically solid. We could not obtain successful service with the wide packing ring, and so we have gone now to the packing ring, which is 9-16 in. in width, and 1 inch or 1⅛ in. in depth, with ⅛ in. clearance around the piston for the wear, so that the piston head will never ride on the packing. We have obtained our best results from that form of construction. This is in a mountain service, with bad water, more or less foaming, and if we could get a set of packing rings to run between shoppings of an engine, we would be very happy indeed.

W. A. Flynn (M. C.): I think there is one point which should be taken into consideration in this matter, which is very important, and that is the class of service. We have one division where the cylinder packing in the same class of engines will last only one-third as long as on other divisions. The engines are identical, the weights of the trains are identical, but on the division where we get the short mileage of the cylinder packing the service is very hard, long and continuous. On the other division, where we get the longer life of cylinder packing, the service is fast, but there are frequent stops, and I think that has a great deal to do with it.

Mr. Wildin: I think there is a good deal of importance to be attached to the character of the water. The New Haven

road, the Boston & Maine, and practically all of the New England roads have excellent water.

J. H. Manning, (D. & H.): We are operating about 75 engines superheated. We use two rings, a malleable iron piston head and an extension piston rod. I feel that our greatest results have been obtained by the adaptation of the extension piston rod to support the pistons. We have no difficulty from going from one shopping to another. This is entirely due, as I see it, to supporting the piston head. Previous to that application we had a great deal of trouble with cylinder heads.

R. P. Blake, (Nor. Pac.): On the Northern Pacific we have had a large number of superheater engines in service over the entire system, in varying degrees of water conditions. These engines are equipped with five-feed lubricators, and we have used cast-iron pistons of a box type, with ¾ in. by 1 in. thick rings of a common gray iron mixture. That caused a great deal of trouble from packing ring wear and the losing of the tension in the cylinder.

The question of lubrication was gone into very carefully. Observations of the performance of the engines led us to come to the conclusion that there was little, if any, advantage in the five-feed lubricator. The results we are now securing in cylinder packing wear are probably averaging about 20,000 miles between renewals. This, of course, varies on the different divisions with the class of service and the quality of the water. We are using the Hunt-Spiller packing ring almost entirely on our superheater engines, and since its use have had a great improvement, the principal gain being in getting a ring which would hold out to the walls of the cylinder and not lose its tension. That was one of our great difficulties with the common cast-iron ring.

W. J. Tollerton, (C., R. I. & P.): In closing the discussion, I do not want the impression to go out that the committee wish to recommend the non-superheating of switching locomotives, nor wish to recommend the non-superheating of slide valve locomotives. What the committee did find from their investigation was that the railroads had not as yet gone far enough into the superheating of slide valve locomotives to justify the committee in making such a concrete recommendation, that the committee could offer it to this convention. The same statement can be applied to switching locomotives. Unquestionably, there is an advantage in superheating these locomotives. We have some of them on our lines. But the fact that we have so many large consolidation locomotives that should first be superheated, before the switching locomotives are superheated, was the reason for the committee to frame its recommendations in that way.

I would therefore move that the committee be continued, so that the work of superheating the present existing locomotives can be continued and the results reported to this Association for information.

(The motion was duly seconded, put to vote and carried.)

Report on Equalization of Long Locomotives

The subject assigned to the committee is rather an indefinite one. It is not immediately apparent why the equalization of a long locomotive should require any more special treatment than the same problem on a short locomotive. It is evident that the committee had some difficulty in determining just what was required of it, but the report embodies a very instructive discussion of equalization, and, considering the indefiniteness of the subject, the committee should be congratulated on the report which it has presented. It would seem, however, that there are sufficient matters which need careful investigation which are of enough greater importance than any matter pertaining to equalization to have provided a subject for a report which would be more in keeping with the ability of the members of this committee and of considerably greater value to the association.

W. Elmer, Chairman

The chairman of the committee is William Elmer, superintendent of motive power, Pennsylvania Railroad; and the other members are: S. M. Vauclain, Baldwin Locomotive Works; F. J. Cole, chief consulting engineer, American Locomotive Company; O. C. Cromwell, mechanical engineer, Baltimore & Ohio; J. F. Enright, superintendent of motive power, Denver & Rio Grande; C. H. Rae, assistant superintendent of motive power, Louisville & Nashville, and C. B. Young, mechanical engineer, Chicago, Burlington & Quincy.

The simplest form of wheel base is the 0-4-0, or four-wheel switcher. In order to allow the wheels to follow the irregularities in the track without materially changing the loads on the journals, it is necessary to adopt the three-legged stool principle, commonly called the three-point suspension. Both ends of the rear driving springs are anchored directly to the frames, and these springs, having equal arms and resting on the driving boxes, deliver the load they carry directly to the journals of the back axle and thus constitute two of the three legs of the stool. The front springs have their rear ends anchored to the frames and their front ends connected to a cross equalizer, the center of which is attached to a frame brace, as shown in Fig. 1. If the weight of the spring-borne parts of the engine be denoted by W, and the distance of the center of gravity of this mass from the front axle be A, and from the rear axle B, then the weight carried by the front axle will be $\frac{W B}{A + B}$, and the weight carried by the back axle will be what is left over after subtracting the weight on the front axle from the entire load, or $W - \frac{W B}{A + B}$. Since the front springs are provided with a cross equalizer, these springs form a unit support S_1, located midway between the springs and on the center line of the axle, thus constituting the third leg of the stool. The load carried is $S_1 = \frac{W B}{A + B}$. The rear springs are independent of each other, not being provided with a cross

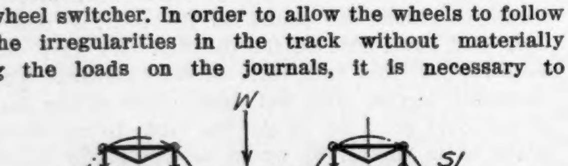


Fig. 1

equalizer, and form the unit supports S_2 and S_3, the load carried by each being $\frac{1}{2}\left(W - \frac{W\,B}{A + B}\right)$.

On a locomotive of the 0-6-0 type, having six driving wheels and no truck, the back ends of the front driving springs are anchored directly to the frames, while a cross equalizer is provided between the front ends of the same springs. This

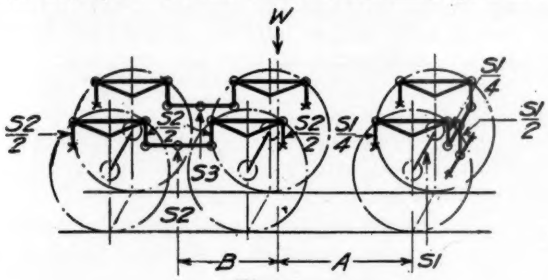


Fig. 2

forms a unit support S_1 which is located midway between the frames and on the center line of the front axle. The front ends of the second springs and the rear ends of the rear springs on each side of the locomotive are anchored to the frames, while the other ends of the springs are connected to each other through longitudinal equalizers. Usually these longitudinal equalizers are equal-armed, in which case the unit

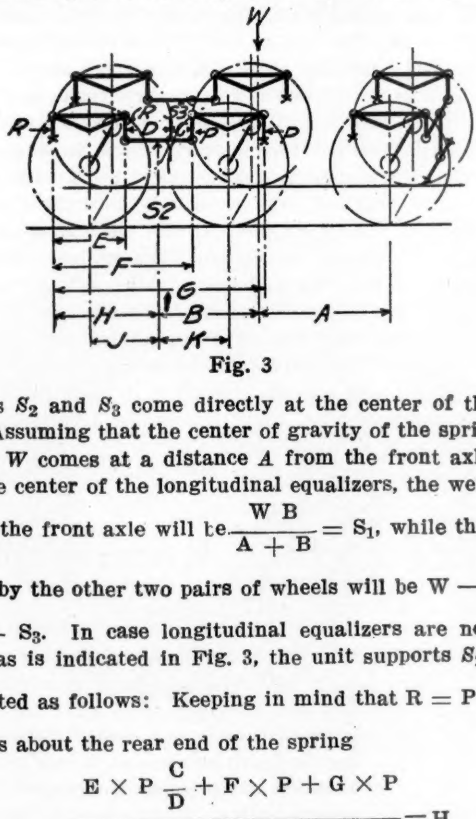


Fig. 3

supports S_2 and S_3 come directly at the center of the equalizers. Assuming that the center of gravity of the spring-borne weights W comes at a distance A from the front axle and B from the center of the longitudinal equalizers, the weight carried by the front axle will be $\frac{W\,B}{A + B} = S_1$, while the weight carried by the other two pairs of wheels will be $W - \frac{W\,B}{A + B} = S_2 + S_3$. In case longitudinal equalizers are not equal-armed, as is indicated in Fig. 3, the unit supports S_2 and S_3 are located as follows: Keeping in mind that $R = P\frac{C}{D}$, take moments about the rear end of the spring

$$\frac{E \times P\frac{C}{D} + F \times P + G \times P}{2\left(P\frac{C}{D} + P\right)} = H,$$

which locates S_2 and S_3. Assuming the center of gravity of the spring-borne parts W located back of front axle at a distance A, then the weight carried by the front axle is $\frac{W\,B}{A + B}$ while the weight carried by the rear axles is $W - \frac{W\,B}{A + B}$ the weight carried by the second axle being $\frac{J\left(W - \frac{W\,B}{A + B}\right)}{J + K}$

and by the rear axle $W - \frac{W\,B}{A + B} - \frac{J\left(W - \frac{W\,B}{A + B}\right)}{J + K}$

Eight and ten driving wheel locomotives with no trucks are handled in the same way as above, the designer taking care to anchor the spring hangers to the frames between the drivers, between which the center of gravity of the spring-borne parts comes. If this point is overlooked there will be danger of some of the wheels not carrying enough weight in case the springs or spring hangers are not properly made and a derailment may occur.

Fig. 4 represents a Mogul or 2-6-0 type locomotive. The spring hangers in this type of locomotive should be anchored to the frame between the first and second drivers and at the rear of the third drivers, as the center of gravity of the spring-

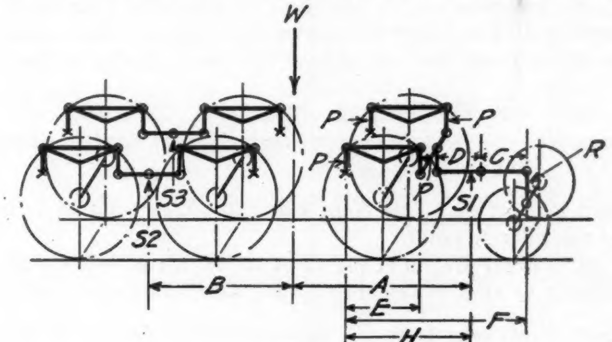


Fig. 4

borne parts comes between the first and second drivers. Referring to the front system of the equalization and remembering that $R = 2P\frac{D}{C}$, the location of the front support may be found

$$\text{thus, } \frac{E \times 2P + F \times 2P\frac{D}{C}}{4P + 2P\frac{D}{C}} = H.$$

From this the distance A from the front unit support S_1 to the center of gravity of the spring-borne parts can be found. Generally the arms of the levers between the second and third pairs of drivers are equal, so that the rear unit supports S_2 and S_3 are located half-way between the second and third driving axles and at a distance B from the center of gravity of the spring-borne weight W and the weight carried by each pair of wheels can be readily found.

Locomotives of the Consolidation, or 2-8-0, type and Decapod,

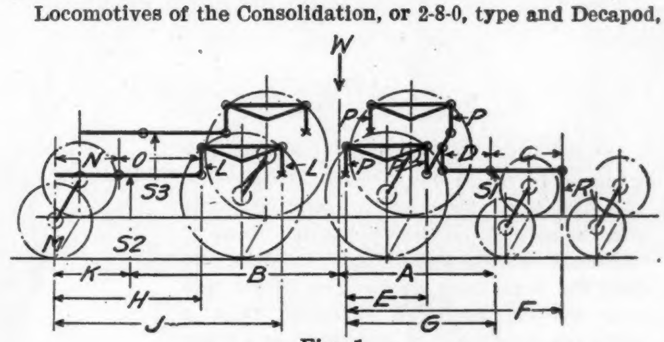


Fig. 5

or 2-10-0, type, are handled in a similar way, the front system of equalization consisting of the truck and one or two pairs of driving wheels, depending on the location of the center of gravity of the spring-borne parts.

In locomotives of the American, or 4-4-0, type, no cross equalizer is used, the center plate of the engine truck forming the front unit support S_1, while the center of the equalizers on each side of the locomotive between the drivers form the rear unit supports S_2 and S_3. This form of equalization is very simple and gives very little trouble. With the addition of another pair of drivers, forming the 4-6-0 type, a trailer truck, forming the 4-4-2 type, or a third pair of drivers with a trailer truck, forming the 4-6-2 type, the equalization becomes more complicated and unless it is properly designed trouble

may be expected. In all of these types of locomotives, as well as any other type, the equalization systems should be divided as near as possible to the center of gravity of the spring-borne parts, as, if this is not done, there is danger of engine truck not carrying its legitimate load, which may result in a derailment.

In Fig. 5 is indicated the spring rigging for an Atlantic (4-4-2) type locomotive, the method of determining the weight distribution being as follows:

Referring to the front system of the equalization, P represents the load on each of the spring hangers of the springs over the front driving wheels, while $R = \frac{2PD}{C}$ represents the load applied to the front engine truck center plate. Taking moments about the rear ends of the front driving springs we have $\dfrac{E \times 2P + F \times \frac{2PD}{C}}{4P + \frac{2PD}{C}} = G$, which gives location of front unit support S_1. This point may fall on, in front of or back of the fulcrum point.

In the rear system of the equalization, L represents the load carried by each of the spring hangers of the springs over the main drivers and $M = \frac{OL}{N}$ represents the load applied to each trailer truck box. Taking moments about the center of the trailer axle we have $\dfrac{H \times L + JL}{\frac{OL}{N} + 2L} = K$, which locates the rear unit supports S_2 and S_3.

Having found the location of the three points of support, S_1, S_2 and S_3, then distances A and B from the center of gravity of the spring-borne weight W can be found. Then the weight carried at the front support $S_1 = \frac{W\,B}{A + B}$, this weight being equal to $4P + R = 4P + \frac{2PD}{C}$, from which the amount of load carried by each axle can easily be found. The supports S_2 and S_3 together carry the load $W - \frac{W\,B}{A + B}$, the load carried by each axle being found as indicated above.

Following the general principles laid down, the weight distribution of any properly designed locomotive can be accurately determined. There are, however, locomotives in service in this country in which the spring rigging has not been properly designed, and these locomotives require constant attention to see that the different axles carry the proper weight. In some cases the driving springs are so large and stiff that the engine truck may be entirely removed without making any practical difference in the height of the coupler. Under conditions of worn wheels, axles, etc., or improper spring hangers the truck may not carry sufficient weight for safe operation.

DISCUSSION

C. B. Smith, (B. & M.): We have had difficulty in maintaining our Pacific type locomotives with properly level equalizing arrangement, and I regret in reading the paper that a more definite suggestion for properly equalizing Pacific type locomotives as well as Atlantic type locomotives has not been given in as clear outline as in the case of some of the more obvious types of equalization. If anything could be added in this respect I think it would be a worthy addition to the paper.

William Elmer: As to the question raised by Mr. Smith, the equalizing of certain type of engines is certainly a formidable proposition. There are, as most of us know, various methods of equalizing. On some engines the truck forms one of the supports, the front pair of drivers is permitted to carry its own spring-borne loads, and in the other the two rear drivers and the trailer are equalized into one system, and is flexible, and that is a departure from the three-legged style, which is used on many of the railroads in this country, and used satisfactorily. The method explained in the paper, which I stated the committee put in especially for the benefit of the members who might be familiar with the Pennsylvania practice, was especially brought forward for the purpose of indicating there is one method of solving the problem of equalizing the Pacific type engine. We had exactly the same troubles which I imagine a number of other roads have had in equalizing the Atlantic and Pacific engines, and while this method of equalizing the first pair of drivers with the engine truck has not yet had very much use in various parts of the country, it certainly has given us satisfactory results, and it may be that some of the members will wish to try it on their roads and see whether or not it will overcome their difficulties.

Design, Maintenance and Operation of Electric Rolling Stock

At the 1913 convention Mr. Quereau read a paper in which he directed attention to the fact that steam railway motive power men may at any time be called upon to maintain electric locomotives and cars, and that the experience acquired in steam railway service is more essential than a thorough knowledge of electricity as a training for the handling of electrical equipment. A committee was appointed and presented a report last year dealing entirely with maintenance and operation.

This year the report takes up the design of electric locomotives and calls attention to the use of delay statistics compiled to suit the needs of the motive power department.

C. H. Quereau, Chairman

C. H. Quereau, superintendent electrical equipment, New York Central, is chairman of the committee. The committee has been enlarged and now includes a representative of practically every steam railroad operating electrical equipment to any extent. The members of the committee are: G. C. Bishop, superintendent motive power, Long Island Railroad; G. W. Wildin, mechanical superintendent, New York, New Haven & Hartford; J. H. Davis, electrical engineer, Baltimore & Ohio; R. D. Hawkins, superintendent motive power, Great Northern; T. W. Heinzleman, general superintendent motive power, Southern Pacific, and A. E. Manchester, superintendent motive power, Chicago, Milwaukee & St. Paul.

COMMUNICATING POWER FROM MOTORS TO DRIVERS

It has been considered best not to include in the report descriptions of foreign practice, not only because these methods are largely experimental as yet, without accepting standards, but as well because the foreign locomotives are of comparatively small power.

In the design usually used on electric surface cars and as applied to the Detroit River Tunnel engines, approximately

half the weight of the motors is carried on the truck transom and the balance on the axle of the driver, the power of the motor being transmitted through single reduction pinions and gears. On trolley cars there is generally a pinion on but one end of the motor shaft. With motors exceeding 250 to 300 h.-p. there is usually a pinion on both ends of the motor shaft, driving corresponding gears fastened to the driving axle. This is the case with the Detroit River Tunnel electric locomotives.

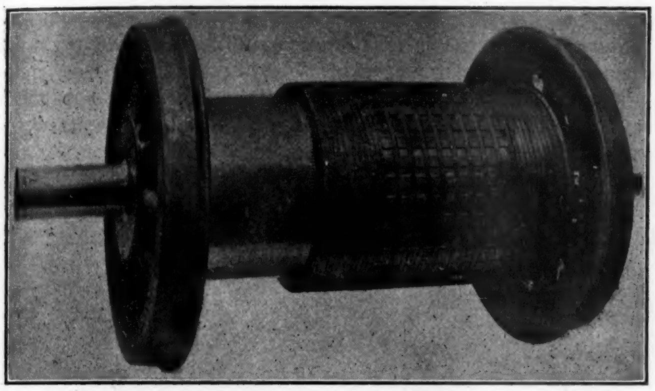


Fig. 1.—New York Central Gearless Motor

There is a motor for each pair of drivers, and about half its weight is carried by springs.

The first New York Central electric locomotives had a four-wheeled guiding truck at each end. The drivers are in the central group of four, of larger diameter than the wheels in the guiding truck; the armature is mounted directly on the driving axle. There is sufficient clearance between the armature and pole pieces to allow dropping the drivers as easily as those of a steam locomotive which has had the main and side rods removed. The armatures of these motors are not spring-supported. There is a motor for each pair of drivers. This has led to the opinion they would be hard on the track. The fact is there has been no track distortion or undue wear of the rail.

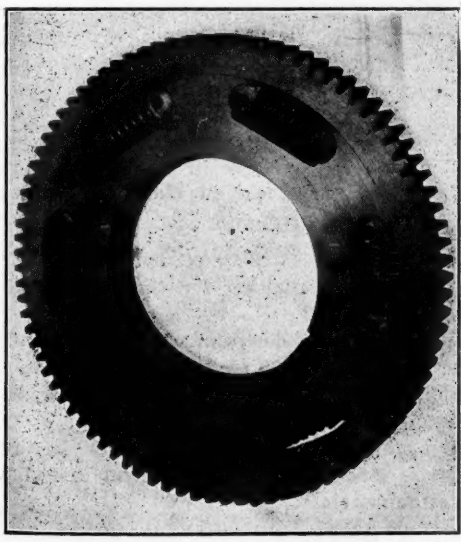


Fig. 2.—Flexible Gear Assembled

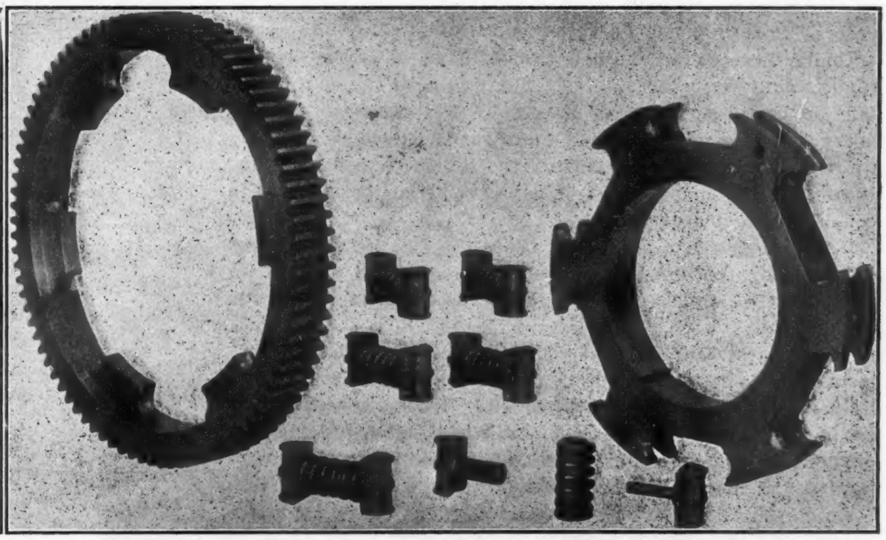


Fig. 3.—Flexible Gear Parts

Fig. 1 shows one of the gearless motors by itself. All of the New York Central electric locomotives are equipped with similar gearless motors.

Figs. 2 and 3 give a general idea of a spring, or flexible gear, for transmitting the torque of the motor to the driver, used on single-phase commutator motors to soften the alternating impulses of the motor, and have been applied to the Chicago, Milwaukee & St. Paul direct-current electric locomotives recently built, resulting in an exceedingly quiet-running machine. The spring gear has been in service too short a time to warrant final conclusions being drawn, but in all probability these will be favorable. The Milwaukee passenger engines run successfully at 60 m. p. h.

In the running gear of the Pennsylvania electric passenger locomotives the motor is mounted on the main frame and transmits its power through main rods to a jack shaft, and this in turn to side rods. The driving mechanism, except the side rods, is spring-supported. There are no gears. Each motor drives two pairs of drivers.

Fig. 4 shows how the pull of the Norfolk & Western motors, which have a pinion on each end of the armature shaft, is transmitted through a jack shaft to side rods, and through these to the drivers. As in the case of the Pennsylvania engines, the driving mechanism is cushioned by springs, except the side rods. There is a motor for each pair of drivers. In service the pinions and gears are covered by a gear case.

Fig. 5 shows a more recent type of quill drive, used on New Haven electric passenger, freight and switching engines, all of which are geared. In this design the torque of the motor is transmitted to the drivers through curved arms attached to the quill, the outer end of these arms compressing coiled hour-glass springs which are seated on the driving-wheel center. In this design the entire motor is spring-supported.

Summary.—Experience with electric locomotives has not been sufficient to warrant a final conclusion as to the merits of the various systems of transmission of power from motors to drivers. The fact that scarcely two orders for electric locomotives have been built from the same plans is good proof of the above statement and, in view of the infancy of electric traction as applied to steam railways, it will not be surprising if a variety of designs will continue to appear.

It is interesting to note that the Scotch yoke, which has been used rather frequently on foreign electric locomotives, has not been applied in America.

Considering only the means of transmitting power from the motor to the drivers, including cost of repairs and losses by friction, the designs without gears or transmission rods are the most efficient for train speeds exceeding 45 or 50 m. p. h. Below these speeds the gear and pinion are probably the most efficient.

The jack shaft has so far been found not entirely satisfactory, as it appreciably increases internal friction and it has been found difficult to keep it from pounding and running hot. The quill springs have given rather more trouble than is

desirable by breaking or becoming unseated. Where gears are used, some design of spring or flexible gear will probably be found desirable for steam railroad electrification.

DELAY STATISTICS

An inquiry directed to seven steam railways using main line electric traction disclosed the fact that, though they all kept statistics of train delays due to defects of their electric equipment, no two compiled them on the same basis. On some roads a train delay is included in the reports when it amounts

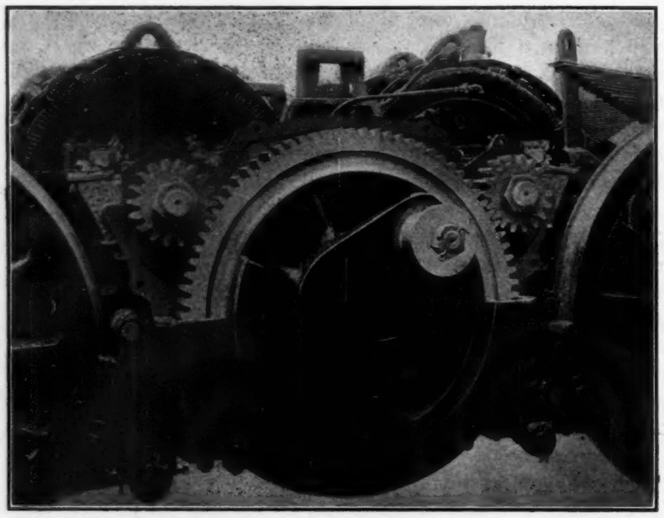


Fig. 4.—Transmission Gears of the Norfolk & Western Electric Locomotives

to one minute and only when it amounts to ten minutes on others. Some reports separate man failures; others do not.

Under these conditions it is evident that, while the present reports may serve local needs admirably, there can be no fair or useful conclusions drawn by a comparison of the delay statistics of any two of these roads. Because of these wide variations, it seems certain the different roads can not have the same ends in view or have not given the matter the consideration it deserves.

It is probable in a number of cases the delay statistics are compiled by the operating department from a departmental standpoint without considering the needs of the motive-power department.

What object should be sought by the motive-power department in preparing the statistics showing train delays due to failure of equipment and enginemen? We believe it should be to so compile them as to form a basis for judging the efficiency of the equipment itself and of the organization maintaining and running it. The statistics should show separately the delays caused by the mechanical parts, such as brake shoes, couplers and air brakes; the electrical parts, such as motors, contactors and resistance, and delays due to man failures, such as improper proportion of motor and trailer cars, tight brake connections or a circuit breaker not closed by the motorman, and the minimum delay to be included in the records should be low enough to uncover defective equipment and handling.

As a general proposition, the delay statistics should inform the superintendent of electric equipment of every train delay due to the failure of the equipment and the carelessness or ignorance of those operating it. The workable minimum time for a delay should be not more than one minute. A responsible official can not afford to fool himself by recording only such delays as are greater.

It is the opinion of the committee that trailer-car mileage should be included with motor-car mileage for all multiple-unit car statistics. It is quite evident that a motor car in combination with two trailers is required to do more work than a train of three cars, each of which is a motor car. Including the trailer car mileage gives a fairer measure of the work done. As both classes of the cars are maintained by the same men and the mechanical features are identical, it is impossible to accurately separate the cost of maintenance between them:

In the report of this committee, presented at the 1914 meeting, the use of the unit Miles per Detention rather than Miles per Minute Detention as a basis for delay statistics was recommended. The committee renews that recommendation.

Summary.—There is practically no uniformity in the delay records of railroads at present.

There should be delay statistics, compiled with special reference to the needs of the motive-power department, separate from the division superintendent's.

The motive-power department statistics should show Miles

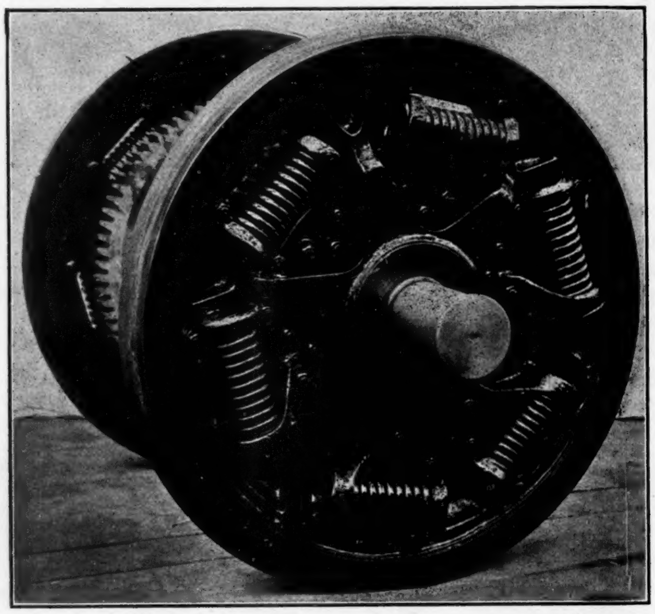


Fig. 5.—Latest Quill Drive for the New Haven Electric Locomotives

per Detention for the guidance of the motive-power department and Miles per Minute Detention for the use of the division superintendent.

The records should show train detentions under the headings: Man Failure, Mechanical Failure, Electrical Failure.

All train detentions of one minute or more should be recorded.

Delay to following trains should not be included in the motive-power statistics. Such records are confusing and misleading, hence more than useless.

DISCUSSION

Mr. Quereau: There are seven members on this committee, each of whom is connected with a railroad which has been electrified to a greater or less extent. No two of these roads have the same system, the same equipment, and that will account for the fact that there is no more definite information in the report than that which is given.

The New York Central is using on its electric locomotives what is known as the bi-polar gearless motor. The motor is mounted directly on the axle of the driver, and the drivers can be dropped exactly as from the steam locomotive after the side and main rods have been removed. That motor is considered dangerous by some people. What I have to say of this motor will apply to the conditions on the New York Central Lines, and other trunk lines using a 100-lb rail, with a good track. What the results would be on a lighter track would be a matter of opinion. It is entirely safe under the conditions under which it is operated on the New York

Central. It is true that the locomotives develop a tendency to what, in steam practice, is known as nosing. When a certain amount of lateral motion is accumulated, no matter where it may be, in the center, in the plates, or in the hub, there is a tendency to nosing. I believe you will agree with me that the track man would be the first to criticise any device which did any damage to his track. It is the universal concensus of opinion among the track men on the New York Central, in the territory in which these locomotives operate, that there has been no single case of deformation, distortion or damage to the track from these motors. I believe that evidence should pass without question. There is no difficulty in keeping the lateral motion in such condition that the engine rides beautifully. I have ridden on most of the designs of electric locomotives, and none of them ride as smoothly and quietly, under the conditions I specify as to track, as the bi-polar gearless motor. The lateral motion allowed is about three-quarters of what would be considered the limit for steam operation. The maintenance of these motors is very low. Previous to my connection with the maintenance of electrical equipment, my experience was entirely in the line of steam railway maintenance. When I undertook the work in which I am now engaged I had great fear of the gears. My idea was that it would wear out, break, and make all sorts of trouble. That fear has entirely disappeared. We have gears which have made 200,000 miles on 200-horsepower motors. With the modern heat treated steel I think we may reasonably expect 300,000 miles at 30,000 miles a year. We can forget the gears and pinions and simply watch them once in a few years.

In connection with the matter of drive for electric locomotives, there is a very interesting article in the Electric Railway Journal of June 10, by Mr. Shepard, which I have no doubt you will be interested in reading.

Frank Rusch, (C., M. & St. P.): I am not in a position to talk very much about the electrification of our road. But, as far as I am informed about it, the operation has been a success, and far beyond our expectations. Possibly if I come to the convention next year I can tell something about operating motors over the Rocky Mountains.

G. W. Wildin (N. Y., N. H. & H.): We have about 16 switching locomotives of the geared type, with a pinion on each end of the armature. There are solid gears on the driver. We find that in this case the flexible gear would be much more satisfactory, due to the fact that when you want to put a new pinion on one end of the shaft and an old pinion on the opposite end, one pinion is doing the major portion of the work until it wears down and the other pinion takes hold. That is in the case of a rigid gear. In the case of a flexible gear you can put on a new pinion with the old one without difficulty.

We have a remarkable record as regards the operation of these 16 switching locomotives. We have gone something like 26 months without detention to the switching service due to failure of the engine. We are contemplating the purchase of 20 or 30 more, with very little change as to size and construction, simply strengthening up a number of parts which we found to be a little weak in design. We have 36 freight locomotives in operation between our Harlem River terminal and New Haven, a distance of about 65 miles. We are hauling 3,000-ton trains with two locomotives operated in multiple. We have about 47 passenger locomotives and are getting between shoppings on these locomotives about 110,000 miles. We are gradually bringing the cost down to compare favorably with steam locomotives. These are of a complicated type, being both alternating current and direct current locomotives. Naturally, we would expect more trouble from a locomotive of this kind than a locomotive of the straight alternating current or straight direct current type. Such trouble as we have comes in changing from one system to the other, especially in the winter. When we pass from the third rail to the overhead system the pantograph is rather sluggish, not being operated on the direct current zone, and in the reverse direction the third rail shoe fails to go down properly, due to the fact that snow and sleet accumulate on it.

Prof. L. S. Randolph: I think it would be a good plan if the committee could formulate some system by which there could be some uniformity in the reports in regard to the detentions and failures.

Mr. Quereau: I want to impress on the gentlemen here that the mechanical men in charge of maintenance of electrical equipment are in a new field, not particularly in the electrical end of it, but in the mechanical end. Electrical engineers, six or eight years ago, were cocksure, each school by itself, as to what was coming. Now they do not know so much about it. Mechanical men knew a lot about locomotive matters, as to what ought to be. They do not know so much as they did, because experience has shown that we cannot apply directly to the electrical locomotive all the experience we gained in the steam locomotive.

(The committee was continued.)

Co-operation With Other Railway Mechanical Organizations

This committee, formed as a direct result of the suggestion made by F. F. Gaines in the presidential address last year, has availed itself of the experience of various railway mechanical organizations in the investigation of costs for doing various kinds of shop work. Contributions to this committee report were received from the Traveling Engineers' Association in the form of a paper on Educating Road Foreman, by W. H. Corbett, a former president; from the Association of Railway Electrical Engineers in a paper on Cost Keeping for Railroad Shop Power, by E. Wanamaker; from the General Foremen's Association and from the American Railway Tool Foremen's Association in a paper prepared by J. J. Sheehan, the president of that association.

John Purcell, Chairman

John Purcell, assistant to the vice president in charge of operation of the Atchison, Topeka & Santa Fe system, is chairman of the committee.

The other members of the committee are: F. C. Pickard, master mechanic, Delaware; Lackawanna & Western; F. O. Bunnell, formerly engineer of tests, Rock Island Lines; W. P. Carroll, master mechanic, New York Central; E. S. Fitzsimmons, mechanical superintendent, Erie; J. H. Davis, electrical engineer, Baltimore & Ohio, and G. W. Seidel, superintendent motive power, Minneapolis & St. Louis.

During the year the committee has been in close touch with various railway mechanical organizations, and in following out the instructions of the Executive Committee in the investigation into the cost of doing various kinds of shopwork, has solicited their assistance. Several organizations have volunteered assistance in the preparation of

papers on subjects peculiar to their organizations, and the committee submits these papers as an appendix to its report, with an expression of its appreciation for the assistance rendered by the different organizations.

HOW BEST TO EDUCATE THE ROAD FOREMAN, THE ENGINEER AND THE FIREMAN

By W. H. Corbett

Ex-President Traveling Engineers' Association

It seems to be the general opinion in the railroad world that the firemen of to-day are not up to the standard in efficiency and loyalty to the company. I think this is not true. There are just as good men employed to-day, but conditions have changed. For instance, pooling the engines has a tendency to make the enginemen indifferent. To-day, a fireman has been relieved of practically all duties except firing the locomotive, consequently he can not be so interested in his work as the fireman of twenty-five or thirty years ago, who was obliged to do everything himself excepting the heavy repairs.

It makes but little difference where the new firemen come from, whether the farm, the section gang or the back shop, if you only can get the right material. I think nineteen years is not too young They should have at least a good common-school education, possess good health and strong physical endurance, so as to stand hard labor.

After a man is taken on as a fireman the first thing to do is to start him in the right way at the beginning. If a traveling fireman is employed, he should look after him for a few days, riding with him on his first student trips, instructing him in his new duties and showing him the way to fire an engine right. What he learns at this time is most apt to stay with him. If he learns careful habits, he is sure of being more careful later. It is not so easy to change fixed habits. Sending him out on a switch engine alone is not doing the fair thing by him or the company either. If a traveling fireman is not employed the best fireman could be sent out with the new men for a short time to start them in the right way.

To the average fireman it does not seem worth while to use his time in studying combustion or how to get the "maximum amount of heat from the minimum amount of coal"—he thinks that will come to him during his term of firing; but when you do find a man who devotes part of his time to studying out these problems, you will find that he is at the head of the list, and when promoted, he will soon head the list of competent engineers, as the more he learns, the more observing he will become.

The railroad companies should insist on the enginemen taking the progressive examination on machinery, air brakes, train operation, as well as "Safety First" rules. They should also be obliged to visit the air-brake car where a competent instructor is always employed.

A paper read at the Traveling Engineers' Convention* a year ago outlined a plan for the making of better enginemen—a system of education and development of the firemen from the day they are employed until they are full-fledged engineers.

I know by experience that the firemen take kindly to instructions and show great interest in the different equipment, and believe that something done along the lines suggested in that paper would be a step in the right direction.

A good fireman will usually make a good engineer; a careless and indifferent one is not apt to change after promotion, so the greatest possible care should be used to secure the right kind of men in the first place. and then educate them properly.

I always encourage railroad men to talk shop when they get together, to get into arguments about their work, to ask questions of any one who may give them an insight to what they are seeking. An engineer might get many useful ideas from the trackman, trainman, or from the roundhouse force. Too much information on any part of the locomotive can not be given to those whose duties are in engine service. While the engineer will get much assistance in this way he must derive most of his knowledge from training and experience.

It is most important that the engineer make correct reports as to the condition of the locomotive and the work they require done. Some will merely state, "Engine blowing," Lubricator won't work," "Injector don't work," not giving any specific information that would assist the roundhouse force in locating the trouble, thereby causing useless expense in time and labor, as well as keeping engine out of service. Another thing: an engineer should not be above doing small jobs on his engine, even if it is not in the schedule.

The man who is selected for road foreman has been acquiring an education during the years he has been in training as engineman. He has been giving such close attention to his work that he has had few failures and his engine has been kept in good condition. He has been progressive and efficient, commanding the confidence and respect of his associates and of the officials. For these reasons he has been selected for the position, and now to help him understand what is required of him, he can do no better than consult with others who have successfully filled the position, attend the Traveling Engineers' Convention and other railroad club meetings, until experience gives him the confidence he needs.

You may explain to a man the duties that are required of a road foreman, but if he has not in his own make-up the inborn qualities that are necessary to the making of a good mechanic and the ability to handle men, your time is wasted. One of the absolutely essential things is, that he loves his work and is almost tireless, as his work is not only "from sun to sun," it is really never done. With the mechanical ability with which nature has endowed him he must have some executive ability, as he is sort of "go-between" between the officials and the men, and must be perfectly fair to both sides when necessary, making them see that their interests are the same.

He should arrange to hold division meetings, with the enginemen occasionally and discuss their work that is of general interest to them, and when they are in trouble or need advice about their work they should feel free to go to him. He should, if possible, know the condition of every engine and how it is being handled, also personally know all the enginemen in his jurisdiction. He must be so reliable that when he makes a report about an engineman or the condition of an engine, his statement may be considered correct.

To sum it all up, the fireman, the engineer and the road foreman must study to improve and advance. In order to excel, they must have that spirit of pride in their work which will keep them up to the standard. The experience and the knowledge they are acquiring each day will make them a valuable asset for any railroad.

*This paper was abstracted in the October, 1915, issue of the *Railway Age Gazette, Mechanical Edition*, on page 508.—Ed.

COSTKEEPING FOR RAILROAD SHOP POWER

(Contributed by the Association of Railway Electrical Engineers, upon request of E. Wanamaker)

The accompanying Table I—Skeleton Form for Costs and Load, together with Table II—Distribution of Costs—outlines a method that will permit a cost comparison on the total power cost figure only, or the costs may be run down and subdivided to any degree of fineness desired, by each individual company; the relative cost per unit of shop output being decided by the monthly production of the shop.

In order to arrive at the first or primary total cost of power produced for any one day or month, it will be necessary to equip the power plant with meters to measure all boiler feed water. Then using evaporation figures the approximate total number of pounds of steam generated may be found. (A closer figure may be obtained by using steam flow meters on

each boiler.) Taking the weight of fuel from bills or invoices and including all costs of production as shown on sheet No. 1 the cost per 1,000 lb. of steam may be ascertained—also the daily and monthly steam cost.

In cases where exhaust steam is used for heating purposes it should be ascertained by checking radiation against steam and hot water return meter, what percentage of the total number of pounds of steam used for power during month is again used for heat.

Itemized Cost of Power.	Daily Cost.	Cost per 1 000 Lb. of Steam.	Cost in Equivalent K. W. H.
Labor	00 000	00 000	00 000
Oil—Quantities, kinds and costs	00 000	00 000	00 000
Waste—Quantities, kinds and costs			
Maintenance Material			
Packing			
Machinists' and Boilermakers' Labor			
Coal—Price per ton, including freight			
Water—Quantity—Price per 1 000 gal.			
Handling of Material by Store Department (at so much on the $1.00)			
Shop Pro Rata			
Interest—Depreciation—Taxes and Insurance on Total Power Plant Investment			
Total Cost per Day			
Total Cost per Month			
Total Cost per Year			

SHOP OUTPUT FOR THE CURRENT MONTH.

Engines	
Cars	
Shop Orders	
Percentage Shop Orders to total work done	

SHOP LABOR.

	Machinists.	Boilermakers.	Smiths.	Carpenter.	Electrician. Craneman.	Pipe Fitter.	Tinsmiths.	Painters.	Clerks, etc.	Helpers.	Laborers	Not Listed Elsewhere.	Total.
Office Superintendent of Shops									14			1	15
Office Assistant Supt. of Shops									5			1	6
Machine Shop	72								1	7	12	40	132
Toolroom	32								1	8	1	27	69
Rod and Link	36									1	6	10	53
Air Brake and Injector	14									1	1	3	19
Steam Fire, Dr'v'r Brk., Grates						13						19	32
Locomotive Department	69								1	43	1	24	138
Stripping and Engine Truck	6					1				5	14	13	39
Scale												7	7
Laborers											26	3	29
Blacksmith Shop			16						1	78	15	71	181
Boiler Shop		110							1	169	7	57	344
Tin and Pipe						26	19		1	6	2	15	69
Carpenter and Tank				23					1	12	2	17	55
Paint								18		7		1	26
Power House					15				1	8	12	22	58
Total	229	110	16	23	15	40	19	18	27	345	99	331	1 272
Car Department	1		1	82				3		33	18	46	186
Round House	19	9		2	1	2				34	6	53	128
Grand Total	249	119	17	107	16	42	19	21	31	412	123	430	1 586
Store Department									25			125	150

Table 1.—Skeleton Form for Costs and Load

To secure a total power cost, and make a charge for the steam heat, it will be necessary to deduct the cost of total number of pounds of steam used for heating from total cost of steam generated during month.

Table II—Distribution of Railroad Shop Power Cost	
Cost of steam generated per month	—
Cost of steam generated per month (daily average)	—
Cost per 1,000 lb. steam generated	—
Deduction for heating with exhaust steam on basis of 1,000 lb. of steam	—
Deduction for power purchased	—
Total costs	—
Electrical Energy.	
Pounds of steam	—
Kilowatt hours generated per month*	—
Cost per month	—
Cost per hr	—
Pneumatic Energy.	
Pounds of steam	—
Cubic feet of air per month*	—
Cost per 1,000 cu. ft.†	—
Hydraulic Power.	
Pounds of steam	—
Gallons of water used per month*	—
Cost per 1,000 gals.†	—
Water.	
Pounds of steam for pumping water supply	—
Gallons of water pumped per month*	—
Cost per 1,000 gals.†	—
Live Steam.	
Pounds of steam required for hammers, testing, etc.*	—
Cost of steam for the various purposes†	—
Live Steam Heat.	
Pounds of steam required for heating purposes*	—
Cost of steam†	—

*These amounts can be subdivided among the various shops and services.

†These costs can be expressed in equivalent kw. hrs. using electrical energy transformation cost figures as a basis.

Using the cost per 1,000 lb. of steam generated as a basis, and ascertaining by the use of test indicators and meters, the quantity of steam used to make the different forms of energy required, the cost thereof may be found in units of kw. hrs., cu. ft., gallons, etc. It is also possible to reduce to and express the cost of all forms of energy in the equivalent of kw. hrs., using the electrical energy conversion or transformation cost figures as a basis, meaning so many pounds of steam per kw. hrs. This will facilitate ease of comparison.

The cost of purchased energy in any form should be added to or inserted in place of that particular form of energy, so that it may be added to the total cost of the whole. Also, that the cost may be properly subdivided and distributed.

TURNING OF TIRES

From the General Foremen's Association

In comparing the time secured from a number of shops for the labor used on this class of work for the purpose of arriving at a uniform figure of time for work performed, shops of as near the same size and capacity were taken for securing this information. Consideration was also given to the grouping of machine tools, crane facilities and other arrangements for the prompt and progressive movements of parts handled through the shop. It is conceded that the best practice is first to handle the parts in large quantities in order to simplify and reduce unnecessary waste movements, that of changing from one size to another.

The time consumed in turning driving tires is largely governed by the make of wheel lathe, brand of tool steel, make of tires, amount of material removed and the finish required.

In making comparison in four up-to-date shops, time of turning tires from floor to floor, was:

Shop No. 1	2.4 hr.
Shop No. 2	2.1 hr.
Shop No. 3	1.5 hr.
Shop No. 4	1.8 hr.

These shops were equipped with up-to-date lathes, good grade of tool steel, proper facilities for handling, but differ on the length of time tires are allowed to run, making a difference in the amount of material removed. Some of the roads insist that tires be finished smoothly, while others do not. With the smooth finished tire it is easier to secure an absolute correct size for the set and reduce some of the sharp flange trouble. Output and Quantity has been the motto, regardless of damage done to expensive machine tools, which, under the abuse of this system, are worn out in a short period of time, while the gain over more conservative methods is not enough to purchase a new tool.

The cost of turning engine truck, tender truck, and coach wheel tires was collected in the same way as that of the driving tires. Time for performing this work is as follows:

	Engine Truck Wheel.	Engine Tender Wheel.	Coach Wheel.
Shop No. 1	2.0 hr.	1.8 hr.	.7 hr.
Shop No. 2	.5 hr.	.5 hr.	.5 hr.
Shop No. 3	.75 hr.	.75 hr.	.75 hr.
Shop No. 4	.5 hr.	.5 hr.	.5 hr.

In the shops having the shorter time of turning for both the driving and the coach wheel tires, was brought about by the use of newer types of machines and better facilities.

With the introduction of the outside bearing trailer the time of turning these tires has increased over that of the inside bearing type in all shops with the exception of the first-mentioned shop. This shop turns all trailer tires in a driving wheel lathe, for both inside and outside journal types, with the tires mounted on the wheels. At the other shops the length of the axle necessitates the removal of the wheels from the axle and the tires are turned on a boring mill, separately, or by shrinking the tires on a mandrel, or wheels pressed on a temporary axle and then turned in a wheel lathe. The last-mentioned way has proved the most successful at these

other shops on account of the tires on these roads being equipped with the "Mansel" retaining ring. This ring necessitates the removal of a number of rivets in order to remove the tire and shrink it on a wheel of suitable size as to be able to perform this work on the wheel lathe.

Time of turning inside bearing trailer tires:

Shop No. 1	2.5 hr. per pair
Shop No. 2	1.1 hr. per pair
Shop No. 3	3.0 hr. per pair
Shop No. 4	2.5 hr. per pair

The first-mentioned shop turns tires on trailer wheels with the outside bearing in the same time as the inside type, or two and one-half hours. There was only one other shop where figures could be obtained for the turning of tires on trailer wheels with outside journals. This shop dismounted the wheels from the axle and turned them on the boring mill. The total time of this operation was five hours and forty minutes per pair. They also dismount these wheels and press on a temporary mandrel, turning tires in a regular driving tire lathe. This time was two hours and fifty minutes.

The time of fitting up driving boxes for a 7½-in. journal and 4-in. wedge face for cast iron:

Shop No. 1	6.4 hours
Shop No. 2	6.0 hours
Shop No. 3	8.0 hours
Shop No. 4	6.0 hours

For cast steel of the same size:

Shop No. 1	6.4 hours
Shop No. 2	7.0 hours
Shop No. 3	9.0 hours
Shop No. 4	7.0 hours

The equipment used in the handling of this work varied considerably, especially in the method of machining the driving brass shells for application to that of the driving box. Two of the shops turned the brass in a check, where a shoulder would be left on the hub end of the brass which was pressed in the box, so as to prevent brass from working out should it become loose. The first and fourth shops performed this class of work on a drawcut shaper.

In the machining of shoes and wedges for the same size box:

Shop No. 1	1.2 hours
Shop No. 2	1.9 hours
Shop No. 3	1.4 hours
Shop No. 4	1.6 hours

This figure is excessive for this class of work and may be greatly reduced by means of a specially designed chuck by which all shoes and wedges may be machined on the inside and outside at the same time, or with one setting. A figure of twenty minutes for this operation with a chuck of this design has been obtained from a piece-work shop, but it is the opinion that the time given is entirely too low.

(The paper submitted by J. J. Sheehan before the American Railway Tool Foremen's Association on Cost of Small Tools is not included in this abstract of the committee's report. It will be published in an early issue of the Railway Mechanical Engineer.—Editor.)

(The discussion of this report was postponed until Wednesday morning.)

Design and Materials for Pistons, Valves, Rings and Bushings

This is a special committee which is presenting its first report at this year's convention. The committee has rounded up a large amount of information as to the practices being followed by railroads in various parts of the country, which is well presented and analyzed. The portion of the report devoted to the material for piston and valve rings, bushings and other wearing parts, is of especial interest from the fact that apparently a material has been found which meets the more severe conditions which have been imposed during the past few years by the use of superheated steam. This is Hunt-Spiller gun iron, a special quality of cast iron which has been in use for many years. It was originally developed as a material for gun construction and has only comparatively recently been applied to railroad service in locomotive cylinders and valve chambers.

J. Chidley, Chairman

Joseph Chidley, assistant superintendent motive power, New York Central, is chairman of the committee. The members of the committee are: H. T. Bentley, superintendent motive power and machinery, Chicago & North Western; C. F. Giles, superintendent machinery, Louisville & Nashville; A. K. Galloway, master mechanic, Baltimore & Ohio; T. A. Richardson, mechanical superintendent, Chicago, Rock Island & Pacific; G. W. Rink, mechanical engineer, Central Railroad of New Jersey, and W. D. Robb, superintendent motive power, Grand Trunk.

The committee issued a circular of inquiry from which were received replies from 34 railroads, representing about 37,000 locomotives. In general, most roads make no distinction between saturated and superheater locomotives in the design of pistons, valves, rings and bushings, on locomotives equipped with piston valves. Many railroads are using Hunt-Spiller gun iron for pistons, valves, rings and bushings for both superheater and saturated locomotives, while a smaller number use ordinary cast iron for the purpose; a number of roads use Hunt-Spiller iron for superheater locomotives and ordinary cast iron for saturated steam locomotives. Throughout this report the words "Hunt-Spiller" or the letters "H. S." denote Hunt-Spiller gun iron, and the words "Cast Iron" or the letters "C. I." denote other varieties of cast iron.

The mileage obtained depends not only on the material and design, but also on the efficiency of lubrication, the class of service and maintenance. Several roads state that they find no difference in the mileage of the various parts under discussion on superheater and saturated steam engines; others obtain more mileage with the saturated steam locomotives, and a few report more mileage with superheater locomotives.

Piston Valve Bushings.—Of the 34 roads reporting, 8 use cast iron for piston valve bushings on superheater engines and 26 use Hunt-Spiller gun iron. Cast iron is used on saturated steam engines by 17 roads, Hunt-Spiller gun iron is used by 10 roads and 7 roads have no saturated steam locomotives with piston valves. Short bushings are used by 26 roads, while 6 roads favor long bushings, extending across the exhaust passages to the steam-chest cover. The number of roads using

an even number of ports is about the same as those using an odd number. The object in having an even number is to have the bridges come near enough to being opposite each other so that the bushings can be readily calipered over the bridges to measure the amount of wear. The minimum width of bridges varies from $1\frac{7}{32}$ in. to $1\frac{1}{4}$ in.

The largest mileage reported between renewals on superheater locomotives is 300,000 miles, obtained in both freight and passenger service on one of the standard trunk roads with the use of short Hunt-Spiller gun-iron bushings. The maximum mileage reported betweeen renewals on saturated steam

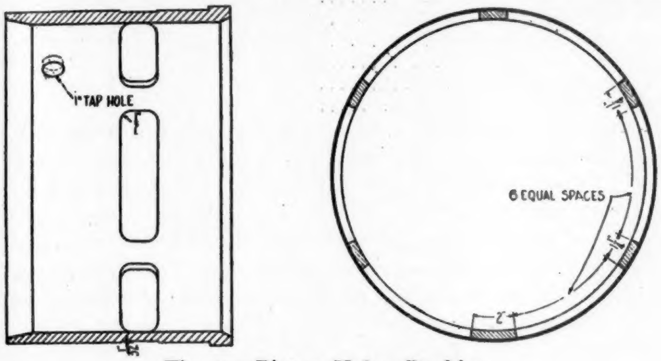


Fig. 1.—Piston Valve Bushing

engines is reported by the same road as being 360,000 miles in both passenger and freight service, using short Hunt-Spiller gun-iron bushings.

The committee recommends the use of short piston valve bushings with an even number of ports and bridges, and with a small number of ports and bridges, not more than eight, and preferably six in number. The committee also recommends the use of a fillet in all corners of piston valve bushing ports. A ½-in. radius is recommended as the standard size of fillet. Rectangular ports are to be preferred to diagonal bridges and diamond-shaped ports. Fig. 1 is an illustration of what the committee considers the best general design of piston valve bushing. The bushing is to be forced in, and the bridges are turned $\frac{1}{32}$ in. smaller diameter on outside than the rest of the bushing, in order to allow the bushing to be forced into position without cracking or burring the edges of the ports.

Piston Valve Packing Rings.—Cast iron is used for piston valve packing rings on superheater locomotives by 5 of the 34 roads reporting; Hunt-Spiller is used by 27 roads; bronze is used by one road, and one road does not state. Cast iron is used on saturated steam locomotives by 13 roads, and Hunt-Spiller is used by 14 roads. The committee has information from one road using bronze piston valve packing rings, indicating there may be a field for further experiment. Figures for the mileage obtained by the use of different materials and designs were submitted by 16 roads. The average figures are given below together with the maximum figures received.

Mileage of Cast-iron Piston Valve Packing Rings

(Replies from 4 roads using C. I. for superheater locomotives and 6 roads using C. I. for saturated locomotives)

	Superheater.		Saturated.	
	Freight.	Passenger.	Freight.	Passenger.
Maximum	27 500	34 750	30 000	49 800
Average	16 400	23 200	20 300	33 200

Mileage of Hunt-Spiller Piston Valve Packing Rings

(Replies from 10 roads using H.-S. for superheater locomotives and 6 roads using H.-S. for saturated locomotives)

	Superheater.		Saturated.	
	Freight.	Passenger.	Freight.	Passenger.
Maximum	60 000	100 000	90 000	100 000
Average	35 900	50 800	48 300	53 800

The familiar L ring is used by the greatest number of the roads reporting. Several roads also use the Z ring and anchored ring. Two large roads use a T ring. Several roads use the standard designs of the American Balanced Valve Company. The data are not available to make a comparison of the various designs upon a mileage basis. The Z ring and anchored ring have the advantage that if broken they are held in place by their shape, but in view of the successful use of the L ring by the majority of the roads reporting, the committee believes this to be the best design of piston valve packing ring.

Piston Valve Bull Rings.—Cast iron is used for piston valve bull rings on superheater locomotives by 22 roads out of the 34 roads reporting; Hunt-Spiller gun iron is used by 10 roads; cast steel is used by one road, and one road does not state. Cast iron is used on saturated steam locomotives by 21 roads, and Hunt-Spiller is used by 6 roads. Figures for the mileage obtained on piston valve bull rings were submitted by 13 roads and the maximum and average of the replies received are given below:

Mileage of Cast-iron Piston Valve Bull Rings

(Replies from 9 roads using C. I. for superheater locomotives and 7 roads using C. I. for saturated locomotives)

	Superheater.		Saturated.	
	Freight.	Passenger.	Freight.	Passenger.
Maximum	150 000	120 000	120 000	165 000
Average	72 000	78 500	64 700	93 100

Mileage of Hunt-Spiller Piston Valve Bull Rings

(Replies from 4 roads using H.-S. for superheater locomotives and 2 roads using H.-S. for saturated locomotives)

	Superheater.		Saturated.	
	Freight.	Passenger.	Freight.	Passenger.
Average	76 500	145 000	85 000	90 000
Maximum	135 000	200 000	90 000	100 000

Cylinder Bushings.—Cast iron is used for cylinder bushings on superheater locomotives by 10 of the 34 roads reporting. Hunt-Spiller is used by 24 roads. One of these roads uses

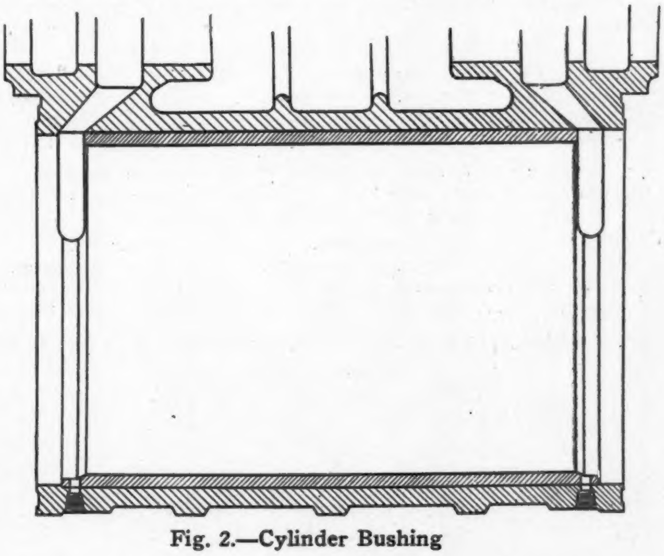


Fig. 2.—Cylinder Bushing

Hunt-Spiller for passenger locomotives and steeled cast iron for freight locomotives. Cast iron is used on saturated steam locomotives by 20 roads; Hunt-Spiller is used by 12 roads, and two roads do not state. The replies were very meager and incomplete with regard to mileage, only 9 roads giving any figures. The thickness of cylinder bushings, as shown on the drawings submitted, varies from ⅝ in. to 1½ in.

Fig. 2 shows a design of cylinder bushing used by several roads. This is a straight bushing, with the ends cut away at the top to provide steam passages. This bushing is placed in position from the front, and is held in position at the back end by a shoulder in the cylinder casting. Of all the bushings submitted this is, in the opinion of the committee, the simplest and best.

Piston Packing Rings.—Cast iron is used for piston packing rings on superheater locomotives by 6 of the 34 roads reporting, and Hunt-Spiller is used by 28 roads. Cast iron is used on saturated steam locomotives by 18 roads, and Hunt-Spiller is used by 16 roads. Figures for mileage obtained on piston

packing rings were submitted by 15 roads. The maximum and average figures are given below for the roads using cast iron and those using Hunt-Spiller.

Mileage of Cast-iron Piston Packing Rings
(Replies of 4 roads using C. I. for superheater locomotives and 8 roads using C. I. for saturated locomotives)

	Superheater.		Saturated.	
	Freight.	Passenger.	Freight.	Passenger.
Maximum	14 000	20 000	32 500	49 800
Average	8 200	14 900	20 800	30 900

Mileage of Hunt-Spiller Piston Packing Rings
(Replies from 11 roads using H.-S. for superheater locomotives and 7 roads using H.-S. for saturated locomotives)

	Superheater.		Saturated.	
	Freight.	Passenger.	Freight.	Passenger.
Maximum	45 000	60 000	60 000	70 000
Average	21 900	25 700	38 600	37 600

Four roads report using Dunbar type packing, the others using the ordinary snap rings. The data in possession of the committee are such that at the present time no recommendation is made as to advantage of either.

Piston Heads and Bull Rings.—Cast iron is used for piston heads or bull rings on superheater locomotives by 16 of the roads reporting, and Hunt-Spiller is used by 16 roads. Two roads are experimenting with pistons having a brass or bronze wearing face cast on the periphery of the piston. Twelve roads submitted figures for the mileage obtained on piston heads and bull rings. The maximum and average of the replies received from the roads using cast iron and those using Hunt-Spiller are given below:

Mileage of Cast-iron Piston Heads and Bull Rings
(Replies from 3 roads using cast iron or superheater locomotives and 7 roads using cast iron on saturated locomotives)

	Superheater.		Saturated.	
	Freight.	Passenger.	Freight.	Passenger.
Maximum	72 000	98 000	62 500	100 000
Average	45 000	61 700	40 700	63 400

Mileage of Hunt-Spiller Piston Heads and Bull Rings
(Replies from 6 roads using H.-S. on superheater locomotives and 3 roads using H.-S. on saturated locomotives)

	Superheater.		Saturated.	
	Freight.	Passenger.	Freight.	Passenger.
Maximum	135 000	180 000	135 000	180 000
Average	69 300	81 300	98 300	113 300

The piston shown in Fig. 3 is an illustration of a box type

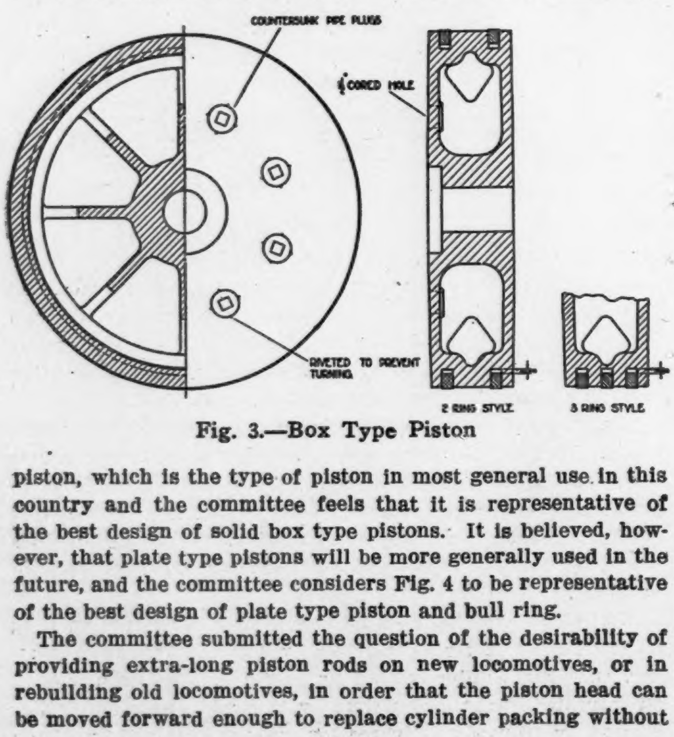


Fig. 3.—Box Type Piston

piston, which is the type of piston in most general use in this country and the committee feels that it is representative of the best design of solid box type pistons. It is believed, however, that plate type pistons will be more generally used in the future, and the committee considers Fig. 4 to be representative of the best design of plate type piston and bull ring.

The committee submitted the question of the desirability of providing extra-long piston rods on new locomotives, or in rebuilding old locomotives, in order that the piston head can be moved forward enough to replace cylinder packing without disconnecting cross-head. The opinion expressed by reports received is almost unanimous in favor of this practice for new locomotives. Most of the reports also favor this practice in the case of rebuilding old locomotives, if it is practical to do so.

The committee presents a summary of the percentage of the roads reporting that use Hunt-Spiller gun iron for the various parts on superheater and saturated steam locomotives:

Percentage of the Roads Reporting That Use H.-S.

	For Superheater Locomotives, Per Cent.	For Saturated Locomotives. Per Cent.
Piston valve bushings	76	37
Piston valve packing rings	79	52
Piston valve bull rings	29	22
Cylinder bushings	71	35
Piston packing rings	82	47
Piston heads or bull rings	47	21

That Hunt-Spiller gun iron is generally considered to be efficient, economical, and for these reasons desirable, can not be doubted, considering the fact that 80 per cent of the roads reporting are using this product in their superheater locomotives for some of the parts mentioned; therefore the committee does not hesitate to recommend its use for piston valve bushings, piston valve packing rings, piston valve bull rings, cylinder bushings, piston packing rings, and pistons or piston bull rings.

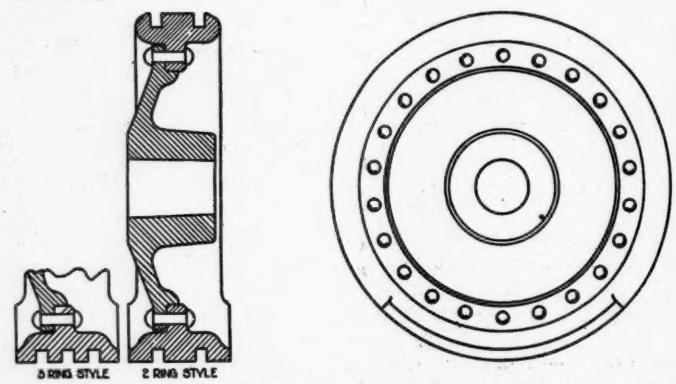


Fig. 4.—Plate Type Piston with Bull Ring

Extended Piston Rods.—The committee included in its circular of inquiry a list of questions on the use of extended piston rods. Eighteen roads report experience with extended piston rods. Three roads out of the 18 have entirely discontinued the use of extended piston rods as a result of their experience, and several others find them to be of no advantage. On the other hand, several roads state that a saving is effected by the use of the extended piston rods. It is the contention of some that the use of extended piston rods reduces the wear of cylinder bushings and packing rings, due to the fact that they are relieved of the weight of the piston, with a consequent reduction of friction inside the cylinder. On the other hand, there is the increased first cost and the cost of maintenance of the extended rod and its cross-head, cross-head guide and extra set of rod packing, if this arrangement is used.

The committee finds that most of the roads using extended piston rods are using a small cross-head on the front end of the extended rod; in fact, only one road reports the use of any other device. This road uses an arrangement in which the extended piston rod slides in a brass sleeve.

The Cole type of piston rod extension is in most general use. This arrangement is described as consisting of a miniature cross-head at the front of the extended rod, which slides on a cylindrical surface, rigidly supported and easily located on the cylinder head. The wear of the extension cross-head on the guide is taken care of by lining up between the small cross-head shoe and its body. The packing on the extended rod is easy of access and can be repaired without difficulty. The extension guide is self-centered on a circular flange of the cylinder head, and requires no adjustment in service, as it

can not get out of position. The guide is made with an open top, so that when it is necessary to remove the guide it can be dropped from the rod.

Twelve roads have reported the minimum size of cylinders used in connection with extension piston rods. The minimum diameter of high-pressure cylinders varies from 20½ in. to 29 in., the average being over 24½ in.

Nine roads state that there is no increase in expense of maintaining rod packing with extended piston rods, and 3 roads state that the expense is increased. One road states that the expense of maintaining piston rod packing is doubled by the use of the extended piston rod.

Lubrication by oil cups is almost universal, only one road using the splash system for extended piston rods.

Open-hearth steel is very generally used for extended piston rods. Experiments with vanadium steel or other special alloy steels have not developed to a point where the committee can recommend them for this purpose.

From a careful consideration of the replies, the committee concludes that there is no particular necessity for the use of extended piston rods, except where railroads traverse hilly country where long stretches of drifting is usual. However, where its use is desired, we advise the necessity of such a diameter of extended rod as to prevent springing, and are of the opinion that in no event is the extended rod necessary on cylinders of 20 in. diameter and less.

(The discussion of this report was postponed until Wednesday morning.)

Alloy Steel in Locomotive Design

Mr. Pomeroy's paper is one which should prove of value to all motive power men, especially those who are interested in design. There has been a great deal said and quite a good deal accomplished in the past few years toward reducing the weight of locomotives, particularly as regards reciprocating parts, by the use of heat-treated and alloy steels, but there is much still to be accomplished. Mr. Pomeroy's paper shows in some detail what may be expected in the way of reducing weight by the use of special material and higher fiber stresses, and he also goes into a discussion of the various alloy steels in a manner which will help railway men to get a clearer idea of their character and how they may be used.

L. R. Pomeroy

Mr. Pomeroy's experience eminently fits him for the preparation of such a paper. He was for nine years with the Carnegie Steel Company, introducing basic boiler steel for locomotives and special forgings; subsequently he was engaged in the same kind of work with the Cambria Steel Company and the Latrobe Steel Company, jointly. He also spent three years with the Schenectady Locomotive Works, as assistant general manager, and for six years was with the General Electric Company. For some time he was chief engineer of the railway and industrial divisions of J. G. White & Co., and was also employed with the Safety Car Heating & Lighting Company and the United States Light & Heating Company.

SOME years ago, when the writer had occasion to investigate the manufacture and fundamental principles underlying the well-known Coffin process, certain laws concerning the general characteristics of open-hearth steel were verified and illustrated.

Subsequent study proved that these principles, being fundamental, were as applicable to-day as at the time the original investigation was made, therefore a brief statement of some of the elements entering into and governing the behavior of steel under heat treatment may be justified.

Carbon exists in steel in two principal states, "hardening" and "non-hardening."

Carbon Characteristics, Brinell Theory

Hardening carbon is that form of carbon formed in steel which is produced by being heated to a high red heat and then completely and quickly cooled by quenching in water. Non-hardening carbon is that form of carbon found in steel which has been heated to a red heat and slowly cooled. If steel is heated to a certain temperature, *W*, nearly all its carbon changes to hardening carbon, and the change is quite sudden. If steel is cooled slowly from temperature *W*, the carbon remains in the hardening state until a somewhat lower temperature, *V*, is reached, when it begins to change to non-hardening carbon. This change is somewhat slow, so that if the steel be suddenly cooled in water there is not time for the change to take place, and the result is hardened steel.

There is a certain chemical force in the change of carbon which causes a breaking-up of the crystals when the change is from non-hardening to hardening. On this point the following experiment is interesting:

Two steel bars, *A* and *B*, in close proximity and bar *A* supported at the ends, were placed in a reverberatory furnace. In 150 sec., at a low yellow heat, the bar *A* began to bend, and went down 1.06 in. After the next 120 sec., bar *A* was again examined, but no further evidence of bending was perceptible. Upon removing from the furnace 5½ min. later, and slowly cooling, the total deflection was found to be 1.06 in., showing that practically all the bending occurred during the two minutes while it was passing a certain critical range, beyond which it ceased to bend. During this time, bar *B* was allowed to remain in the furnace, and, in consequence, was very much hotter than *A*. Bar *B* was thereupon withdrawn and supported at the ends in a similar manner, but showed absolutely no deflection. Clearly, then, the bending was not due to the temperature as such, but to something which happened while the temperature was passing *W*, and apparently during the change from the cement to hardening carbon. Again, if steel is heated to, say, a dull red heat below *W*, or say *V*, the carbon is not affected by either rapid or slow cooling.

Toughened by Manipulated Cooling

If a small bar of axle is heated to temperature *W*, and cooled as rapidly as possible in water to temperature *V*, and then allowed to cool slowly until cool, it will give a perfectly amorphous fracture; no crystals nor crystal form will be visible under a powerful glass. It will be very tough and ductile, and show a marked increase in the elastic limit (between 40 and 50 per cent will be the result) without appreciable change in the ultimate strength.

Chernoff, in his experiments on steel, proved that steel, however hard it may be, will not harden if heated to a temperature lower than what may be distinguished as a dark cherry red, *V*, however quickly it is cooled. On the contrary, it will become sensibly softer and more easily worked with

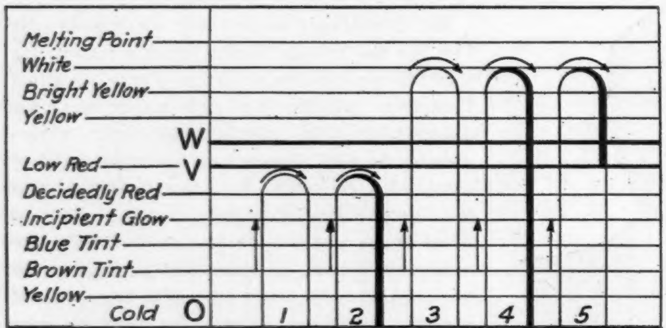
a file. When the temperature is rising—has reached *W*—the substance of the steel quickly passes from the granular or crystalline condition to the amorphous or wax-like structure, which it retains up to the melting point. The points *V* and *W* have no permanent value in the temperature scale, but their positions vary with the quality of steel.

Effects Due to Various Methods of Cooling

The tests from which the diagram in Fig. 1 was made are as follows:

1. When steel is heated to a point inside or below the dull red point, *V*, that is, the point in which the carbon is in the non-hardening state, the structure is not affected, whether cooled quickly or slowly (as per curves Nos. 1 and 2 of the diagram).

2. When heated higher than *V*, the carbon changes to hardening carbon, and from this temperature (above *V*) the method of cooling has everything to do with the character of the structure. For example: No. 3 of the diagram, which



N.B.-Fine lines indicate slow cooling and Heavy lines rapid cooling

Fig. 1.—Temperature Diagram

was cooled slowly, showed larger crystals after cooling than the original piece. It was also sensibly softer and less able to stand shock or strain.

3. On the contrary, No. 4 of the diagram was cooled quickly from the same temperature as No. 3, producing a hard, brittle structure, easily broken and structurally inadequate for machinery purposes.

4. No. 5 of the diagram was heated to the same temperature as Nos. 3 and 4, quenched to the temperature of Nos. 1 and 2, *V*, or the point when the carbon is in the non-hardening state, then allowed to cool slowly and completely. In this specimen is reproduced substantially the principles on which the Coffin process is founded. The commercial measure of the result is that the elastic limit is raised about 30 per cent, while the ultimate tensile strength is increased only about 3 per cent.

The conclusions of other investigators have confirmed the foregoing, but the statements on this point by such eminent authorities as Messrs. G. L. Norris and H. V. Wille, are presented as a more scientific description of the phenomena.

If heat is applied to a bar of normal steel, it will become sensibly hotter, with each increment of heat, up to a given point. Thereupon, further application of heat, instead of increasing the sensible temperature, it is absorbed by the steel in some molecular change or reconstruction within the metal, lasting during a more or less protracted period. As this rearrangement is completed, the sensible temperature begins to increase again regularly. During this absorption or retardation of sensible temperature, the expansion of the steel bar is checked, its magnetic qualities disappear, and the steel develops the quality of becoming hard if quenched. In cooling, the reverse changes take place. To a certain temperature the steel cools regularly, then ceases to cool for an interval, and heat is actually given off sufficiently to cause a visible rise in temperature, after which the cooling proceeds regularly; the steel regains its magnetic qualities and loses its hardening power. Consequently, steel quenched at temperatures below the beginning of the calescence point is not hardened. This is illustrated by the accompanying tests made with a 0.50 open-hearth steel. The temperature range of the calescence point is from about 1300 deg. F. to 1380 deg. F., the point of maximum retardation being at about 1315 deg. F. The range for the recalescence point is about 1274 deg. F. to 1184 deg. F., the maximum retardation taking place at about 1256 deg. F.

Treatment.	Elastic Limit.	T. S.	Elong. in 2 in. Per cent.	Red. of Area. Per cent.	Hardness No. Brinell.	Hardness No. Scleroscope.
As rolled	49,000	88,000	27.0	47.5	166	24
Quenched in water from: 1200 deg. F.	42,500	91,000	25.0	49.5	187	27
1290 deg. F.	40,000	89,500	27.0	50.5	217	30
1337 deg. F.	38,000	96,500	13.5	42.0	228	32
1382 deg. F.	....	142,000	2.0	0	302	48
1517 deg. F.	....	....	...	...	555	75
Heated to 1517 deg. F. and cooled slowly to 1290 deg. F. and quenched	....	135,500	0	0	430	63
Heated to 1202 deg. F. and quenched ..	....	121,000	0	0	375	56
Heated to 1112 deg. F. and quenched ..	39,000	89,000	23.5	42.0	187	28

From these examples it is evident that there can be two methods of procedure in tempering, drawing back, letting down or annealing or hardening steel. The article can be heated to the predetermined temperature and then allowed to cool in the air, or it can be quenched in oil or water. The second method possesses advantages over the first in the greater uniformity in results obtainable in the heat treatment of a large number of pieces, and also that it facilitates output without impairment of quality.—*G. L. Norris.*

The theory of heat treatment has been understood by metallurgists for many years, but this has been largely applied in a practical way only during recent years. Some years ago Dr. Sargeant, who is now connected with the Crucible Steel Company of America, exhibited a small experiment at the Franklin Institute which showed in an interesting way the basis of all heat treatment of steel. He heated in a flame of a Bunsen burner a thin plate until he obtained a red spot. Upon removal from the flame he showed that this spot gradually decreased in brightness until a certain temperature was reached, whereupon the fall of the temperature was arrested and the spot glowed with a marked increase in luminosity, showing that some internal change had taken place in the molecular structure in the steel which caused the elevation in temperature in a manner similar to that produced by the combination of sulphuric acid and water.

If the steel is quenched at this temperature, it will retain its molecular structure, and if examined it will be found that steel so quenched is of maximum hardness, with a less loss of ductility for that particular grade. Furthermore, the molecular structure will not be changed unless the steel is again heated above this critical or recalescence point. It follows, therefore, that a steel so quenched can be annealed below this temperature without change in the molecular structure, but with a great increase in ductility. A steel so treated has a much higher elastic limit and a much greater reduction of area than steel which has been subject to the ordinary annealing process. The sole advantage of all of the modern high-grade steel consists solely in an increase in the elastic limit, so that the designer is enabled to reduce the weight or size of any detail by the use of a higher unit stress, or to increase the factor of safety by the retention of the same unit stress as in a straight annealed steel.

Extremely high elastic limits can be obtained by the use of the various alloys to assist the hardening effect of carbon, such as nickel and chromium, or of the various tertiary alloys, such as chrome nickel, chrome vanadium, or chrome titanium. Steel can be produced having an elastic limit of 150,000 lb. with sufficient ductility to prevent failure by shock by the use

of some of these alloys with proper heat treatment so that engineers are able to design parts with unit stress as high as 100,000 lb. per sq. in. in place of about 20,000 lb. per sq. in. for a straight carbon annealed steel. It is hard to grasp the great benefits derived from this enormous increase in the elastic limit.—*H. V. Wille.*

*Tempering.—However, steel is too brittle for most purposes, hence it is generally somewhat toughened by tempering, by slightly reheating it. The higher the temperature to which the steel is heated in tempering, the tougher does it become, with corresponding loss of hardness, but at least, in certain cases, with considerable gain in tensile strength. Steel, when tempered, though much more ductile than when hardened, is far less ductile than when annealed.

Ordinary hardening, without subsequent tempering, is employed for uses which demand great hardness, but for which toughness is not needed, for example, where friction alone is to be resisted. Thus, hardened steel bushings, rings, collars, plug gages, as well as lathe tools for cutting very hard cast iron and unannealed steel, may be used untempered.

Cooling Media (Howe)

*Rapidity of Cooling Effected by Different Media.—In general, the greater the specific gravity, specific heat, mobility, latent heat of gasification, coefficient of expansion and thermal conductivity, and the lower the boiling point and the initial temperature of the cooling medium, the more suddenly will the immersed metal cool.

Mercury cools steel extremely rapidly because it is extremely heavy, that is, the surface of the steel is exposed to a great mass of it, and decidedly mobile; water cools it rapidly because, while very mobile, it has high specific heat and latent heat of gasification and low boiling point. Oil cools steel slowly because it is comparatively light and viscid, and has low specific heat and boiling point. A low boiling point favors rapid cooling, because the temperature of a liquid can not rise above its boiling point.

Lead Quenching (Howe)

Lead quenching, instead of oil, is practiced by the Chatillon et Commentry Company of France (as reported by Howe, 1891), especially for forged projectiles. The metal is first heated to the desired temperature (probably *W* of Brinell, Fig. 1) and then plunged into a bath of molten lead, in which the piece cools undisturbed.

Owing to its density and high conductivity, lead should at first cool the piece more rapidly than oil or water, but later, as the temperature of the piece, sinking below *V* (Fig. 1), approaches that of the lead bath, the cooling grows slower and slower, ceasing asymptotically. Lead quenching cools the metal more quickly through the higher ranges of temperature and less quickly through the lower ranges, than oil quenching. We may surmise that the fine grain acquired when the metal is heated to *W* will, therefore, be preserved better by lead than by oil quenching. The accompanying table gives some results of the Chatillon Co. from lead quenching.

*Howe. Metallurgy of Steel.

PROPERTIES OF STEEL ANNEALED AFTER DIFFERENT KINDS OF HEAT TREATMENT

	Per cent Carbon Est.	T. S. When Annealed After				Elastic Limit When Annealed After				Elongation Per Cent in 8 in. After			
		Forging.	Quench'g in Water.	Quench'g in Oil.	Quench'g in Lead.	Forging.	Quench'g in Water.	Quench'g in Oil.	Quench'g in Lead.	Forging.	Quen'd in Water.	Quen'd in Oil.	Quen'd in Lead.
1	0.10	44,000	51,638	......	......	26,170	35,130	......	......	30	20	..	..
2	.20	43,379	64,419	48,499	44,375	25,601	48,357	36,979	26,738	34	28	30	31
3	.30	65,567	80,785	71,256	72,251	36,979	52,340	41,815	43,806	24	21	24	22
4	.40	70,402	88,039	81,496	74,100	39,112	59,024	53,477	45,939	20	18	22	21
5	.50	77,941	105,391	98,706	86,190	43,806	72,251	65,567	51,486	21	15	19.5	20
6	.60	85,336	112,360	102,404	89,603	46,935	81,070	70,462	53,193	18	13	17	17
7	.70	91,026	126,583	113,782	99,550	52,624	88,181	73,958	61,158	16	14	14	16
8	.80	93,870	137,961	119,472	106,671	54,046	92,448	76,803	56,891	17	11	13	14
9	.90	98,137	140,806	123,739	108,093	54,046	98,870	79,647	64,002	16	10	13	15
10	1.00	106,671	153,606	129,428	115,205	55,469	106,671	81,070	69,691	17	10.5	11	15

The Coffin process, at the time of the writer's investigations, represented about the last word in steel for locomotive forgings, but now we are entering on a new period, due to the advent of more scientific methods of thermal treatment for both carbon and alloy steels.

Limits in Fiber Stress

The methods now in use in determining the dimensions of various locomotive parts, are based on a fiber stress dependent on the elastic limit of carbon steel, the latter ranging from 36,000 to 40,000 lb. per sq. in. The following fiber stress limits represent prevailing practice, when calculated by formulæ similar to method proposed by the writer:

1. Piston rods .... 8,000-9,000 lb. per sq. in.
2. Crank pins .... 15,000 lb. per sq. in.
3. Main driving axles.................... 21,000 lb. per sq. in.

Approximate Formula for Piston Rods

There are different ways of calculating fiber stress for Items 2 and 3. Because of this fact, the writer presumes to submit the methods used by him, which are dependent on the limits for fiber stress given (Item 3), and are not comparable with the limits given of other formulæ, using different methods and base lines, although by the simpler method of the writer's, the same diameter of axle is reached. The limits given for piston rods, namely, 8000 to 9000 lb. per sq. in., are in tension for the least area through the key way, while the body of the rod can be approximated from the formula:

$$0.0324\sqrt[4]{(\text{Piston Thrust}) \times L^2}$$

When L equals the distance, or length, of the piston rod between the cross-head and piston head.

Diameter of Main Crank Pins and Axles

According to Rankin and others, the lever arm for combined bending and torsion, when the bending moment is the greatest, is one-half of the distance $C\,b + \sqrt{Cb^2 + Ac^2}$ as noted on Fig. 3. The writer has shortened this formula to read, $L_e = \sqrt{cb^2 + ac^2}$.

To still further reduce the labor of calculating axle diameters, Fig. 4 and Fig. 5 are presented; Fig. 4 for diameter, and Fig. 5 for fiber stress. Fig. 4 is based on a fiber stress of 21,000 lb. The method of reading the diagram is indicated by the dotted line. From the top of the sheet, at boiler pressure, read down to the diagonal for cylinder diameter, at which point to the right, read the piston thrust, thence horizontally to the left, to the diagonal for lever arm A C (ab of Fig. 3), and thence upward.

[The paper here includes formulas and diagrams for the diameter of crank pins and axles. An article by the author on this subject which includes these diagrams, etc., will be found in the Railway Mechanical Engineer for April, 1916, page 171. Mr. Pomeroy also discusses at some length in the present paper the properties of heat-treated manganese steel, the effects of manganese, nickel-chromium steels, etc.—Editor.]

Foreign and American Practice Compared

The following remarks concerning American and French balanced compound locomotives of practically the same capacity will illustrate the general difference between foreign and American practice:*

(A)	15-in. High Press. Piston. Lb.	25-in. L. P. Piston. Lb.
French Locomotive	104	233
American	218	362
Marine (at same Boiler Pressure)	91	193

**C. R. R. Review*, October 12, 1912.

The American high pressure piston weighs 110 per cent, and the low pressure piston 55 per cent more than the French pistons of equivalent capacity. While compared with marine practice, of same boiler pressure, the American pistons respectively are 140 and 88 per cent heavier.

Reciprocating Parts of Similar American and French Locomotives.

	Lb. Am.	Lb. French.	Saving. Lb.
High Pressure Piston and Rod	332	198	134
High Pressure Cross-Head and Pin	310	238	72
Low Pressure Piston and Rod	481	344	137
Low Pressure Cross-Head and Pin	310	238	72
High Pressure Main Rod	668	310	358
Low Pressure Main Rod	623	410	213
	2,724	1,738	986

Of these comparative weights, the American practice shows nearly 1000 lb. greater, or 57 per cent. This reduction in weight is made possible by the use of material of relatively higher elastic limit than the steel used here for similar construction. The weight of reciprocating parts exerts a thrust or pull on the crank pins due to inertia, the force increasing from zero to maximum at each revolution.

These forces at speeds, in miles per hour, equal to the diameter of the driving wheels in inches, for the French and American engines just described, compare as follows:

	French. Lb.	American. Lb.	Inc. Per cent.
High Pressure Main Rod, C. H. End	13,000	29,000	
High Pressure Recip. Parts, C. H. End.	21,000	30,800	
	34,000	59,800	=75
High Pressure Con. Rod, Crank End	12,200	26,500	
High Pressure Recip. Parts, Crank End.	15,300	22,500	
	27,500	49,000	=78
Low Pressure Con. Rod, C. H. End	19,300	27,400	
Low Pressure Recip. Parts, C. H. End.	28,100	38,100	
	47,400	65,500	=38
Low Pressure Con. Rod, Crank End	17,400	24,500	
Low Pressure Recip. Parts, Crank End.	20,400	27,800	
	37,800	52,300	=38
Total	146,700	226,600	=54

The pistons of the French locomotives are of forged steel, with a tensile strength of 85,000 to 90,000 lb., while the pistons of the American engine described were provided with cast-iron pistons having a tensile strength of, say, 20,000 lb.

Hollow (Circular) Sections

The use of hollow axles and crank pins is such a fruitful source of saving, and also of such benefit for purposes of inspection, that it would seem as if the practice would become general. As the increase in outside diameter is so small to produce an axle of equal strength with the equivalent solid axles that for old equipment a hollow axle can be substituted without changing the size of boxes.

Saving in Weight of Reciprocating Parts Due to Increase in Fiber Stress of About 20 Per Cent

In connection with the engineers of one of the locomotive companies a detail study was made of the possible reduction in size, and consequent saving in weight, by virtue of using carbon vanadium steel, without heat treatment, other than annealing, after forging; such manipulation, as regards apparatus and skill, is well within the capacity of any primitive forge shop. The figures obtained represent only one-half of the inherent difference in elastic limit, as compared with carbon steel, and the balance can be properly apportioned as an increase in the prevailing factor of safety. This material, not requiring elaborate and skilled heat treatment, can be purchased in billet form, the same as carbon steel, and forged in the locomotive builders' or railway companies' shops.

The writer wishes to call attention to the fact that the use of the untreated carbon vanadium steel, just mentioned, is but an intermediate step between carbon and the full possibilities of heat-treated alloy steel. This intermediate step represents a decided advance, and may meet prevailing practice in a satisfactory way. When, however, in the future, more exacting conditions arise, then the higher gra:'es are available, with the same promise and degree of satisfaction, as now obtained by the automobile builders and others.

The following abstract of conclusions from this study is:

First.—That the reductions in weight shown have been effected by an average increase in unit stresses of only 19 per cent over the builders' standard practice. Also that the reductions have been made without resort to special design, but simply by modification of the sections of the parts as applied and in conformity with the builder's practice as to bearing pressures and other conditions in which the strength of the material is not a feature.

Second.—That with this average increase in unit stress the following savings in weight of the rough turned forgings or billets are effected:

(a) On 10 coupled, 2-10-2 locomotives, 3000 to 3500 lb.
(b) On 8 coupled, 2-8-0 locomotives, 2000 to 2500 lb.
(c) On 6 coupled, 4-6-2 locomotives, 2500 lb.

Third.—The total reductions in the weights of finished parts, per engine, including the equivalent saving in weights of the counterbalances, are as follows:

(a) On the 2-10-2 freight engines, 4000 to 4500 lb.
(b) On the 2-8-0 freight engines, 2000 to 3500 lb.
(c) On the 4-6-2 freight engines, 2000 lb.

Fourth.—In freight engines the saving in weight shown represents an average of six per cent of the actual weight of the reciprocating parts, and about nine per cent of the actual weight of the reciprocating and rotating parts. In the case of passenger engines, the reduction is 8 and 15 per cent, respectively.

			Stress Lb. per sq. in.	Per Cent Inc. in F. S. over Builders' Standard Practice.
Main Rod	Back Stub	Tension	8,375	28
		Bending	14,500	29½
	Front Stub	Tension	7,850	20½
		Ben ing	28,560	19
	Body	Tension	9,750	22
		Combined Centrifugal and Col. Vertical	14,500	21
		Bending as a column sidewise	11,200	12
Front, Back and Intermediate Rods	Eyes Tension		6,500	30
	Knuckles Tension		6,230	25
	Body	Tension	8,800	....
		Centrifugal	8,125	20
		Bending as a column sidewise	9,800	22½
Front and Back Rods.	Eyes Tension		6,250	25
	Knuckles Tension		....	....
	Body	Tension	8,100	....
		Centrifugal	7,700	13
		Bending as a column sidewise	9,906	24
	From Stub Tension		8,125	25
Main Crank Pin Bending			18,000	6
Main Axle Comb. Bending and Twisting			28,000	21
Piston Rod		Tension	11,875	25
		Bending	10,175	7
Average increase over present practice			....	20

In the foregoing statements, the possible saving by using

the same material for pistons and cross-heads was not considered; this would add at least 500 lb. to these figures.

Fifth.—The weight thus saved can be utilized to increase the size of the boiler. For example, the savings effected on a certain 2-10-2 locomotive, would make it possible to increase the heating surface of the boiler to from 260 to 300 sq. ft.

The calculations, which were the basis of the foregoing conclusions, comprehended seven types of locomotives, of which the accompanying figures are typical or representative as illustrating the detail manner of arriving at the results named:

PART (ONE SIDE)	Reciprocating Parts — Saving. Finished Parts Per Side. Lb.
Main Rod, front half	71
Piston Rod	80
	151
Main Rod, back half	109
Front Rod	54
Inter. Rod, front	101
Back Rod	64
Inter. Rod, back	86
Main Crank Pin	104
Front Crank Pin	30
Front Crank Pin Int.	32
Back Crank Pin	32
Back Crank Pin Int	32
Total Rotating Parts	644
Total Rotating and Reciprocating Parts	795
Equivalent Weight in Counter Balance	795
Axles:	
Main	380
Front	408
Front Int	408
Back	408
Back Int	408
Total saving, weight per locomotive	4,784

The reductions represent 5½ per cent of the total reciprocating parts and 9 per cent in the sum of the reciprocating and rotating weights. Since writing the foregoing the writer has been informed that at least 15 per cent in weight could be cut out of the frames. On these particular frames, 15 per cent would represent about 5000 lb. A 5-in. hole in the five axles would represent a saving of 1939 lb. As each 1000 lb. weight cut out of the running gear represents an equivalent of 52 sq. ft. of heating surface, for this particular type of locomotive, it can be readily seen how valuable are such savings.

In presenting the paper Mr. Pomeroy said: There were three principal points we had in view, and probably the paper might better have been described "Some Methods of Reducing Reciprocating Parts or the Dead Weight of the Running Parts of the Locomotive." As alloy steel forms much the larger portion of these parts that was given as a title. It is obvious that this is not a metallurgical paper, and the only point that you are concerned with and the report is concerned with is that there were some combinations or points in heat treatment whereby an elastic limit could be produced that would be well worth while in considering design. The report is based on the hypothesis that this elastic limit was obtainable.

(Mr. Pomeroy's paper was received with the thanks of the association.)

ADDITIONAL EXHIBITORS

The following additional concerns have arranged for exhibit space on the Pier:

Hires-Turner Glass Company, Philadelphia, Pa.—Super or unbreakable glass. Presented by H. G. Hollenberg. Space 132.

Phœnix Manufacturing Company, Mobile, Ala.—Drifting valve. Represented by V. P. McCoy. Space 132.

PRESENTATION TO GILBERT RYDER

The members of the Entertainment Committee gathered for a while last evening to honor Gilbert E. Ryder, the retiring chairman, by the presentation of a large silver berry dish suitably engraved. In presenting it, W. K. Krepps, who has been closely associated with Mr. Ryder on the Entertainment Committee, said in part:

"You have been a hard worker on the Entertainment Committee for a number of years, and were, by your experience and ability, specially fitted to boss one of the biggest and most difficult jobs in connection with the conventions, requiring not only ability to plan and arrange the details, but rare tact and executive ability in putting these plans into execution. We here realize something of the peculiar difficulties which have confronted the committee. Entertainment must not be overdone, and yet it is up to us to see that the convention attendants are made welcome, and that in their spare time—while the conventions are not in session or the exhibits open, and also between conventions—an atmosphere is created which will lead to closer acquaintanceship between the members of the associations and hold them together. Also, it is our pleasure to look after the comfort of the ladies and see that they enjoy themselves.

"Few of those who attend the conventions, and even of those in charge, realize the difficulty of carrying out such a contract. Your record has been truly remarkable, and we have grown to admire and respect you more and more. Everybody has enjoyed themselves, and yet the clean and wholesome entertainment has not in any way detracted from the serious purposes for which the meetings of the associations are intended. For months and months you have been planning details and building up an organization to carry them out. I know I voice the feelings of every member of the committee, and also of the officers of the Railway Supply Manufacturers' Association, in thanking you for your long and arduous work, and in appreciating the diplomacy and ability which you have shown in making the social end of the 1916 conventions the best ever."

EARL ALDRO WESCOTT

Earl Aldro Wescott, consulting engineer of car construction of the Erie, whose death was noticed in the *Daily* of June 16, page 1358, was born in Edgerton, Wis., October 7, 1849, and died in Chicago, June 11, 1916. He began his railroad career in 1871 with the Chicago, Milwaukee & St. Paul at the Minneapolis Shops and remained actively in railroad service until 1913.

He held the positions of master car builder on the Chicago, Milwaukee & St. Paul, Great Northern and Baltimore & Ohio. He left the B. & O. in 1904 and entered the service of the Erie as general foreman of car repairs at Jersey City, N. J. Two years later he was made superintendent of the car department of the Erie System and continued in that capacity until failing health compelled his retirement in 1913.

In recognition, not only of his services to the company, but of his long experience and distinguished record as a car builder, he was given the title and rendered the service of a consulting engineer for car construction.

Mr. Wescott was a sturdy upstanding man of positive character and altogether worthy of the hardy and resourceful pioneer stock from which he sprang. Not always understood and appreciated by the casual acquaintance, he nevertheless made many friendships of the kind that endure. He did a strong man's work like a man. Personally he cared little for the praise of achievement but he was always quick to give it to others. He was singularly mindful of the welfare of those situated less favorably than himself, but his many deeds of kindness and helpfulness were rarely known beyond their recipients.

On the fourteenth of June, 1916, old friends on the Erie and

others who had served with him in the northwest performed the last offices of friendship and laid him to rest, in the family ground, in beautiful Rose Hill Cemetery at Chicago.

AN OLD TIMER ON THE BALL GAME

"Saturday's ball game was all right, but there wasn't proper courtesy shown for each other by the players," remarked an old-timer Sunday morning. "They talked rudely and were too prone to 'knee' the other chap, walk up his shins and make war maps on his face with shoe spikes. Of course, if baseman Alphonse got the ball there first I wouldn't expect him to insist that runner Gaston touch the bag first. Not that. Nor should catcher Chesterfield purposely drop the third strike, then politely boost it into the grandstand so batter Dribble could reach second on a strike out. Not quite that; but a little real courtesy goes a long way sometimes. Take that convention game several years ago when Passmore beat out a scratch hit, then promptly went to sleep on first, while 'Jige' (New Haven) Wildin was waiting for a good one. Finally B. & O. Jeffreys got one over, and how 'Jige' did lean up against that ball with his old hickory! It sailed skyward over the fence, over the inlet far out to sea, whence it was retrieved late that evening by a boy in a row boat. Right here it was that 'Jige' staged a remarkable courtesy stunt. A glance showed Passmore still slumbering on first, and being too courteous to disturb him, 'Jige' hastily decided to make a left-hand home run and dashed for the 'hot-comer.' In vain did third baseman Cliff Beaumont shout that he was going the wrong way; in vain did second baseman Tom O'Brien plant himself squarely in the comet's path; in vain did first baseman Bert Stevenson hang to 'Jige's' foot and get dragged across home plate; in vain did catcher Oviatt kick. Umpire Ben Hegeman declared 'Jige's' left-handed home run not only an undiluted, 100 per cent. efficient four-bagger, but the finest bit of courtesy he had ever seen pulled in a convention ball game."

REPORT OF COMMITTEE ON RESOLUTIONS

Joe Taylor says the report of the Committee on Resolutions, which was read near the close of the convention yesterday, was more enthusiastically applauded than any similar report for years. Some say it is because it was the best; others say the reference to the flag was responsible. The committee members say it is because Joe put so much feeling into its reading.

"Your committee recommends that the hearty and sincere thanks of the Master Car Builders' Association be extended to President MacBain for his well chosen and excellent address, and further recommends that the very pertinent points he made be given earnest consideration by the incoming Executive Committee. We further desire to thank him very particularly for his splendid direction of the affairs of the Association during his term of office.

"That the thanks of the members be extended to the officers of the Association for their unusually excellent work in connection with the conduct of the business of the convention and for their forethought in providing for the comfort and convenience of the members and guests in attendance.

"To the various committees for the careful study they have given the subject in hand and for the very careful preparation of, and able presentation of, the reports.

"To the Committee on Arrangements for its painstaking service evidenced by the very complete and perfect arrangements for the meeting of the Association.

"To the railroads for the many courtesies extended, for the exhibits they have made, and the encouragement they have extended in general in furthering the work of the Association.

"To the hotel men of Atlantic City for the hospitality extended.

"In particular we wish to extend to the Railway Supply Manufacturers' Association our appreciation of the very complete, instructive and attractive exhibit of railway appliances.

"To the technical and public press generally, and in particular to the *Railway Age Gazette* for the daily report of the proceedings and general features of the convention.

"Further, we wish to mention with particular pleasure our appreciation of the attractive arrangement and very complete appointments provided for the convenience and pleasure of the members and guests by the Railway Supply Manufacturers' Association.

"Last, but not least, our thanks are due Ernest Shackelford, general manager of the Pier, for his hearty co-operation and assistance.

"We have noted with particular pleasure the thoughtfulness of the Railway Supply Manufacturers' Association in expressing so pertinenly at this particular time the loyalty of the Master Car Builders to the Banner of Peace,—as described by Mayor Bacharach, 'Sun-kissed and wind-tossed, the red, the white and the blue'—by its very prominent display at this time when the eyes of all are looking to it, and it is 'glorified the whole world through.'"

The members of the Committee on Resolutions were: T. J. Burns, chairman; O. C. Cromwell and John A. Pilcher.

ADDITIONAL MASTER MECHANICS' REGISTRATION

Best, W. N., President; W. N. Best Co.; Blenheim.
Caracvisti, V. Z., Cons. Eng.; Blenheim.
Cole, T. J., M. M.; Erie; Haddon Hall.
Cross, C. W., care Equipment Improvement Co.; Traymore.
Dolan, S. M., M. M.; Dennis.
Graham, G. S., M. M.; D. & H.; Chelsea.
Hoke, H. A., Ass't Eng. M. E. Dept.; Penna.; Dennis.
Marsh, F. B., Asst. M. M.; Penna.
Smock, F. A., M. M.; Penna.

ADDITIONAL SPECIAL GUESTS

Beck, C. R., Dist. Boiler Insp.; B. & O.; Chalfonte.
Bower, W. H., Vice President; Cent. West Va. & So.; Blenheim.
Brown, J. D., Chf. Elec.; B. & O.; Dennis.
Buxby, O. M., Ch. Draftsman; N. Y. C.; Runnymede.
Cassel, Harry, Acc't; Penna.
Dampman, Chas. P.; Eng.; P. & R.
Davis, J. J., Insp. Car Shops; Penna.
Deal, Alonzo W., A. B. Insp.; P. & R.
Deeter, H. H., Foreman; P. & R.
Earle, W. R.; Mech. Foreman; B. & O.; Lexington.
Feagler, Claude, Gen. Loco. & Tend. Insp.; B. & O.; Chalfonte.
Garcelon, H. J., Asst. Eng. Test; B. & O.; Shelburne.
Griest, E. E., M. M.; Penna.; Dennis.
Haenchen, J. P., Foreman; C. of N. J.
Hazel, J. F., Supt.; Del. & Tol. Short Line; Schlitz.
Hedeman, Walter R., Tool Designer; B. & O.; Arlington.
Herr, E. E., Genl. Foreman; W. J. & S.
Heurtault, R., Ch. Insp. & Rep. Eng.; Paris Orleans R. R.
Jost, J. William, Draftsman; P. & R.; Whittle.
Koch, G. B., Genl. Foreman; Penna.
Koch, Phillip, Foreman; P. & R.
Kreider, Charles N., Gen. Boiler Insp.; P. & R.
Larkin, W. H.; B. & O.; Blenheim.
Leonard, W. W., Ass't Ch. Elect.; B. & O.; Dennis.
Ling, August J.; Machinist; P. & R. Ry.
Lukens, H. A., Ass't to P. A.; Penna.; Traymore.
McCarty, J. H., Material Agent; Penna.; Islesworth.
Markland, W. H., Gen. Shop Insp.; Penna.
Martin, C. W.; Penna.
Moyer, Herbert J., Foreman; Atlantic City Ry. Co.
Nusz, E. L., Mech. Insp.; B. & O.; Arlington.
Ott, Wm. B., M. M.; Penna.
Painter, H. S., Engineer; C. of N. J.; Touraine.
Patram, B. F., Foreman Car Rep.; S. Ry.; Fredonia.
Pietsch, T. A., Sp. M. Insp.; B. & O.
Potteiger, H. G., Chf. Cl. Boiler Shop; P. & R.
Robinson, J. J., Gen. Foreman; So. Ry.; Fredonia.
Rogers, J. W., Elec. Super.; W. J. & S.
Schaller, F., Genl. A. B. & S. H. Inspr.; Penna.
Scott, R. F., Foreman; Atlantic City R. Co.
Seidell, F. M., A. B. Insp.; P. & R.
Serp, C. W., M. P. Cl.; B. & O.; Netherland.
Shaeffer, L. W., Foreman; P. & R.
Smith, Jas. D., Foreman; P. & R.
Smith, Wm. M., Fore. Eng. House; P. & R.; Whittle.
Stofflet, Howard A., Elec. Eng.; P. & R.

Conventionalities

B. W. Duer, railway expert of the Maryland Public Service Commission, and Mrs. Duer are attending the convention as guests of Mr. and Mrs. G. T. Cooke.

L. J. Drake, Jr., vice-president of the Galena-Signal Oil Company, succeeding E. H. Baker, retired, is in attendance here for the first time. Mr. Drake has been in the employ of the Galena-Signal Oil for the past 13 years as a representative in the electrical field at Indianapolis.

We surely all regret that Harry "Filter" Finnell will not be able to attend the convention this year. Mr. Finnell is the busy general manager of the Henry Geissell Company, and is very much occupied these days with his duties immediately on the job.

This is the first time for many years that A. E. Manchester, superintendent motive power of the Chicago, Milwaukee & St. Paul, has missed a convention. He is ably represented, however, by C. H. Bilty, mechanical engineer, who is attending the conventions for the first time. F. D. Campbell, general foreman car department, at Tacoma, Wash., is here for the first time.

Jack Wilson, enjoys a number of singular things. He is the only exclusive manufacturer of main steam valves for locomotives; resides in California and runs his plant in Jersey Shore, Pa., and is attending his twenty-first consecutive convention. Mr. Wilson's home is thirty-three miles east of Sacramento, Cal., and he is an authority on fruit ranching. At one time he drove over the entire State of California with a horse and buggy.

E. E. Griest, master mechanic, Pennsylvania Lines West at Fort Wayne, Ind., arrived Tuesday at the convention. He stated that F. T. Huston, who has recently been appointed general car inspector at that point, succeeding O. J. Parks, was taken ill quite suddenly last Sunday, and for that reason could not attend the convention this year. Walter G. Hamilton, foreman of the piece work department at Fort Wayne, has been made assistant master mechanic, succeeding Mr. Huston.

If you get lonesome and want to cheer up a bit go to "Doc" Allen's booth (651) and before you leave you will forget your troubles and go away with a smile. A part of the exhibit is "Fido," a wonderful dog. "Fido" lives in a little kennel and watches every stranger who enters the place of exhibit. If you speak to him sharply he will spring at you; but fear not, for he will not bite you. He is a registered and finely bred animal and you will not only be well repaid for seeing him, but if you can guess his queer comings and goings, in and out of his kennel, "Doc" Allen will present you with a prize.

H. T. Bentley, superintendent motive power of the Chicago & North Western, arrived at the conventions a little late this year. He is full of information regarding the performance of his pulverized fuel locomotive which has been operating for the past nine months. Tests made with that engine show saving of very nearly 16 per cent in the amount of coal as compared with an engine of the same type hand-fired. Mr. Bentley also speaks with pride of the new office building recently constructed at the Fortieth Avenue shops in Chicago, and believes he has the best lighted railroad drawing room in the country.

Top row standing—Joseph Sinkler (Economy Devices Corporation), K. J. Eklund (Pilliod Co.), A. L. McNeill (Central Electric Co.). Centre row—Fred M. Ball (Glidden Varnish Co.), R. J. Himmelright (American Arch Co.), E. A. Averill (Locomotive Feed Water Heater Co.), A. M. Dugan (Bronze Metal Co.), F. W. Venton (Crane Co.). Bottom row—G. H. Peabody (Griffin Wheel Co.), L. S. Wright (National Malleable Castings Co.), R. W. Benson (American Flexible Bolt Co.), John L. Randolph, Chairman (Economy Devices Corporation), J. H. Craigie (Joseph T. Ryerson & Son), H. M. Wey (Kay & Ess Co.), and R. R. Porterfield (Locomotive Superheater Co.).

TRANSPORTATION COMMITTEE

1506

New Devices

TWIN OIL STRAINERS

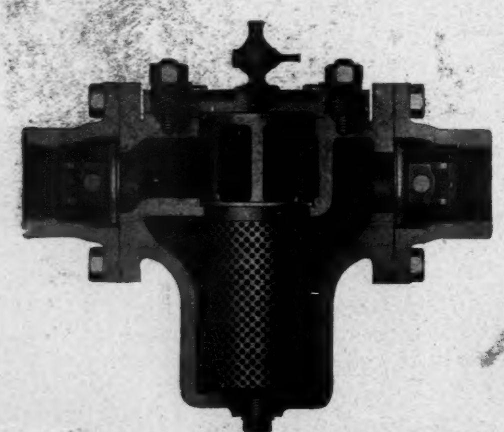
The great difficulty encountered in straining oil is the necessity of shutting down the line every time the strainer becomes clogged. In order to provide for continuous operation the double strainer shown herewith has been developed

A Strainer Basket Removed

by the Elliott Company, of Pittsburgh, and is being exhibited by the Liberty Manufacturing Company, Pittsburgh, Pa.

The sectional elevation shows the arrangement of the passages through one of the strainers, each of which forms a separate compartment in the body casting. The oil enters from the left and passes down and out through the straining basket and thence out of the strainer to the right. The solids remain in the basket.

At each end are gate valves which slide against the face of the valve body. These are mounted on transverse screw shafts which are operated by the hand wheels. When a straining basket becomes clogged, its compartment is closed



Vertical Section Through Elliott Twin Strainer

at both ends by running the valves across the face of the strainer body, the other compartment at the same time being opened. The cap of the clogged strainer may then be removed and the basket lifted out and cleaned.

The caps are quickly detachable. By loosening the nuts about one-quarter turn the slip washers may be removed. The holes in the caps are large enough to permit the caps to be lifted off without removing the nuts. Fillers around the bolts keep the caps properly lined up when they are in place. The slip washers are attached to the caps with short pieces of chain to keep them from being lost.

The body of the strainer is of cast iron and is designed for a pressure of 125 lb. per sq. in. The working parts are of bronze and copper.

HAND FIRE EXTINGUISHER

A hand fire extinguisher which has recently been developed is exhibited by the H. W. Johns-Manville Company, New York. Among the features of interest in this device is the fact that no pumping is required during operation, thus facilitating the accurate placing of the extinguishing medium.

J-M Fire Extinguisher

It is claimed that enough air pressure may be accumulated in the tank by 10 seconds easy pumping to entirely exhaust the charge. An average stream of 30 ft. may be thrown. The extinguishing medium is a volatile liquid which is harmless and non-corrosive. When filled the extinguisher is sealed to indicate at sight that it is in working order and also to discourage unauthorized tampering.

This device is included in the list of approved fire appliances issued by the National Board of Fire Underwriters, and each one bears the label of the Underwriters' Laboratories.

BOILER PRESERVATIVE

In an article published in yesterday's *Daily*, describing a boiler treating material known as "Boiler Kote," it was incorrectly stated that this material is the product of the Flexible Bolt Company. The article should have stated that this material is being exhibited by the American Flexible Bolt Company, the address of which is Pittsburgh, Pa., and not St. Louis, Mo.

FIRE BRICK CEMENT

Exhaustive tests are being made by the use of electric furnaces of the durability of Hytempite fire brick cement made by the Quigley Furnace Specialties Company, New York. These furnaces, equipped with pyrometers produce temperatures reaching 2,900 deg. Cemented fire brick submitted to temperatures ranging from 2000 to 2900 deg., or the melting point of fire brick, show no fluxing of the cement and perfect adhesion even to the point of destruction of the brick. Applications of this cement may be seen in the space of the Quigley Company.

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WE GUARANTEE that of this issue 11,815 copies were printed; that of these 11,815 copies, 11,244 were mailed to regular paid subscribers to the Railway Age Gazette and the Railway Mechanical Engineer; 171 were mailed to advertisers, 300 were provided for counter and news companies' sales, new subscriptions, copies lost in the mail and office use; and 100 copies for distribution at Atlantic City.

THE RAILWAY AGE GAZETTE is a member of the Audit Bureau of Circulations.

Shop Power Costs

At the semi-annual convention of the Association of Railway Electrical Engineers, held Friday at the Hotel Dennis, the matter of analyzing power costs in railroad shops was the subject of a paper by E. Wanamaker, electrical engineer of the Rock Island.

This subject is of timely interest and without doubt offers a most fertile field for investigation with the almost certain result of effecting marked economies in every case. The stationary power houses on a railroad are usually the dumping ground for all the poor coal on the system, and this is typical of the treatment and consideration which the stationary power house equipment generally receives. It is far too often the case that no special attention whatever is paid to the power house operation so long as it is able to furnish adequate power for shop purposes; no question is raised as to whether or not the power house is operating at good efficiency, or what it actually costs to furnish compressed air and steam heat to shop buildings, etc. The officer in charge of power house operation should have at his disposal a complete testing set of water and steam flow meters, draft flow meter, a pyrometer, etc., and these instruments should not only be available, but they should be used so that the actual operating expenses of the power houses on the road can be reduced to a minimum.

Poor operating efficiency will usually be found at every step in the production of power—poor furnace combustion due to improper grates or poor regulation of drafts; low boiler efficiency due often to a collection of boiler scale from time immemorial; loss because of bare steam piping, poor engine or turbine economies, an air compressor with leaky valves, piston head and pipe line, or thousands of feet of steam heat piping simply buried in the ground, etc.

These are some of the opportunities awaiting the efficiency expert in the average railroad power house; but an efficiency expert is only an ordinary type of an individual who has found time to make a careful analysis of operating costs, discover the leaks and apply the remedy with a little application of ordinary horse sense. A consistent keeping of shop power cost records will do much toward obtaining the desired high power plant efficiency wtih reduced operating costs. It is usually a simple matter to stop a leak once it is located.

Mechanical Department Costs

President Pratt brought out a most important point for the convention's consideration when he referred to the attitude of the motive power officer in respect to business questions. How many mechanical officers really know just what the various operation in their department is costing the road? How many of them have taken any really effective steps toward determination of such costs? The keeping of costs on some reliable basis, as suggested by Mr. Pratt, will enable them to see what are the variations in the cost of doing work at different shops on the same road. There are frequently local reasons why one shop cannot do the same work at a cost as low as that at another shop, but there are no good reasons why the difference in price should reach the figure which it frequently does. Railway officers have generally been slow to adopt any methods which are used in industrial establishments, but in the matter of cost accounting at least they might well look into some of these practices very carefully as it is probable that some of them could be advantageously adapted to railroad use. The obsolete and inadequate machine tool is a source of continual expense to railways in these days of large motive power which requires up-to-date machinery for its economical maintenance and if a system of cost keeping did nothing less than show up the false economy of making repairs to large locomotives with this old machinery, its installation would be amply justified.

UNITS FOR MEASURING EQUIPMENT MAINTENANCE

An analysis of the use to which a figure for measuring expenses of repairs of equipment is to be put, while it will not lead to the discovery of a perfect unit, should prevent the use of positively misleading units. The two most commonly used units are the per locomotive or per car, and per locomotive-mile and per car-mile. The Interstate Commerce Commission requires repairs for each class of equipment to be shown separately from bookkeeping charges for depreciation and charges to expenses for the original cost, less depreciation, of equipment retired and also separate from overhead charges. This figure for repairs is, therefore, a better one to take, if a measure of work actually done is to be obtained, than the combined figure for repairs, renewals and retirements which is sometimes taken. If, however, the unit to be selected is for the purpose of showing effectiveness of expenditure as well as policy toward upkeep, we must have also figures showing the condition of the equipment at the beginning and the end of the periods for which comparisons are to be made. So far as we know, there is no way of combining these figures for condition of equipment—percentage in good condition, fair condition, needing repairs, etc.—with the unit cost of repairs.

The per mile run per unit of equipment is a better figure to take than the per unit of equipment. If a quarter of a company's locomotives are standing in white lead it is quite misleading to divide the total number of locomotives available for service into the amount spent for repairs to loco-

motives to get a unit figure for purpose of comparison with a time when all available locomotives were in service. Freight car mileage is the mileage made by foreign cars as well as home cars, whereas the number of cars owned makes no allowance for the balance for or against the company of foreign cars on line. As a measure of effectiveness or adequacy of maintenance expenditures, the freight-car-mile, however, has to be taken with the salt of the knowledge that one company may have a low average mileage per car per day, notwithstanding the fact that its cars are smashed about in yards just as much each day as a road on which the average mileage per car per day is half as high again. In such a case the road with a low average mileage per car per day would appear to have relatively much larger expenses per car-mile if both were spending precisely the same amount relative to the necessity for such expenditure.

The locomotive-mile and the car-mile can not be weighted in any accurate way to make allowance for the proportion of various kinds of equipment in service on different roads. The per locomotive-mile and the per car-mile repair costs, however, make the most dependable unit figures for an index as to what changes need explanation, and that after all is the principal usefulness of all unit statistics.

PULVERIZED FUEL FOR LOCOMOTIVES

AT first glance the report of the Committee on the Use of Powdered Fuel in Locomotives seems a little disappointing in that more service data and information are not given. However, when it is considered that there are only three locomotives equipped with this apparatus and that none of them have been in service any great length of time the reason for the lack of such information becomes apparent. The Chicago & North Western locomotive, which has been equipped for the last nine months, is perhaps the best source of information available at the present time and not until recently have the conditions been such that satisfactory tests could be made. With the equipment this road has, which does not have all of the improvements of that applied to the Delaware & Hudson locomotive, substantial savings have already been shown. It is believed that the question of the storing of the coal, which seems to cause a little apprehension on the part of those discussing the paper, will not develop into any serious problem. It has been stated that some of the metallurgical plants store pulverized fuel successfully in large quantities by placing it in storage in a cool condition. It is necessary to heat the coal to a rather high temperature in order to drive out all its moisture. It usually is then passed directly to the pulverizer and from there to the storage tank, arriving at the storage tank at a rather high temperature. It was suggested that if the coal be allowed to cool between the processes of drying and pulverization, it could be stored in large quantities.

The results of the North Western's nine months' experimentation have shown quite conclusively that from an operating point of view powdered fuel is a success and has a distinct field in locomotive practice. The North Western has not, however, definitely solved the questions of practicability of pulverization and storage, and general reliability of the entire system. The maintenance of the locomotive, especially as regards the fire brick and other parts of the firebox, has been the source of a number of questions as to the effects of the high temperatures generated by this fuel. As was stated in the discussion, with the flame used on the North Western locomotive, having no impinging action on the fire brick, the brick work does not burn out unduly fast, nor does the extreme heat affect the firebox itself nearly as much as under the conditions obtaining with hand firing. The advantages in the use of this fuel, which were outlined by the committee, seem to be borne out by the performance of the North Western's engine. In order to use this fuel successfully, it, of course, must be properly handled. It is necessary to have the coal at the proper degree of dryness and fineness. With undue moisture, slagging will cause trouble, and if it is not ground to the proper fineness, the combustion will not take place as rapidly, causing a coke formation to collect on the brick-work. Next year, with the further development of this form of combustion on the Delaware & Hudson, the Chicago & North Western and the Missouri, Kansas & Texas, the committee, which has been made a standing committee, should have much more definite and valuable information to present to the Association.

ARE YOU GUILTY?

IT IS said of A. L. Mohler, who retires from the presidency of the Union Pacific and the Oregon Short Line on July 1, that he so thoroughly believed in encouraging the men under him to develop initiative that he did everything in his power to help them fit themselves for promotion and positions of greater responsibility and trust. As an instance of this it is related that when he went to the Union Pacific he did not take even his secretary with him. The time is surely coming, and in all likelihood is not far distant, when the head of a railroad or any one of its departments will be most severely criticised if it is found necessary to go outside its ranks to find a man to fill any position. It should be regarded, and surely will be regarded, as a sign of weakness on the part of the organization if it is necessary to follow such a course.

On an important road a certain officer holding a responsible position died suddenly and a recommendation was made by his immediate superiors to the president that certain men on other roads be considered for the position. The president absolutely refused to consider this recommendation and insisted that there surely must be some one already in the service who was capable of filling it. He was told that no such person could be found and that it would be necessary to go outside for a man. Three times he refused to consider doing this. Finally a man already in the service was selected and has made good in no uncertain manner. Meanwhile, the entire staff has been inspired to better efforts, for its members realize that they have a fighting chance for better positions and that desirable places will not be handed to outsiders. The effect of following such a course cannot be overestimated. Every officer should make known his position in this respect in no uncertain terms and should even go farther and insist that any officer or foreman under him will be discharged who cannot on a day's notice recommend a man who can succeed him and has been trained for that particular purpose.

The mechanical departments of some of our railroads have been extremely careless in this respect, but fortunately are gradually coming to see the pernicious effect of neglecting the developing and training of the men. Not many months ago we received an official notice of the appointment of a mechanical department officer on a large road who was taken from a neighboring system. This was followed almost immediately by a letter from one of the officers asking that we make the announcement in such a way as not to attract attention, because he felt that the road would be criticised for the course which it had followed. Probably no greater improvement could be made in the effectiveness and efficiency of the motive power department of that road if, instead of going outside for a man to fill the position, it had been announced that under no conditions would this be permitted. Immediately every officer would have been forced to study more critically those under him and force his subordinates to do likewise.

Could the Master Mechanic Association do a better thing this year than to pass a resolution approving this policy and authorizing the appointment of a committee to study the situation during the coming months and make a complete report at the 1917 convention of every railroad mechanical depart-

ment in this country which had been guilty during the year of going outside of its ranks to fill any position above that of the ordinary workman or mechanic? This report should cite the specific offences.

COLLEGE MEN IN THE MECHANICAL DEPARTMENT

THE following quotation is taken from a letter recently received from the mechanical engineer of a trunk line railroad: "From your own knowledge and experience you are of course well aware that locomotive and car design and maintenance were handled by rule of thumb very largely until the development of steel cars, and the great efficiency required of locomotives has forced the development of railroad mechanical engineering along more technical lines. The field is a wide one, and offers great opportunities for young men, which do not appear to be appreciated by the men themselves; this is not to be wondered at, but I am commencing to feel that it is not appreciated by the mechanical engineering faculties of our large universities, and this latter is a condition difficult to excuse."

Both the Master Car Builders' and the Master Mechanics' Associations have a number of college professors in their membership who have been active workers and have given splendid service to both of these organizations. Surely, therefore, they cannot be accused of lack of interest in railway mechanical department work. Is it not all too true that the railroads have been at fault in not attracting college graduates to their ranks? Industrial organizations keep in close touch with the colleges and send their best men to meet the students and indicate to them the possibilities in the industrial field. The railroads have done very little of this. Then, too, while railroading is a most fascinating occupation it may be that the young men are not attracted by the possibilities of hard and dirty work and, on some roads, the uncertainty of future advancement because of the lamentable lack of methods for closely studying the individuals and selecting and training those who are best fitted for promotion.

After all, would it not be far better and more logical if the railroads were to develop their own college men? This presumes a well organized system for training the young men when they enter the service and of selecting those who are well adapted and show a liking for the work and who indicate that they can profit by further technical study and a college training. The exact procedure need not be discussed here but can undoubtedly easily be worked out if railroad officers will awaken to the possibilities of such a course. It might be that a limited college training could be offered as an incentive for those best adapted and making the best records in their apprenticeship or preliminary practical training. Such scholarships need not be very expensive and it should be understood that the young men would work on the railroad during their vacations.

If such a course were followed time and money would not be wasted in taking into the service a college graduate who had had no railroad experience and who did not understand what he was up against and who possibly would find after he had been in the service for a while that he was not adapted for it.

The scheme outlined above is not Utopian and is not a beautiful theory that has been developed in the mind of the editor. It has been advocated on many occasions and is actually being tried out on at least one road. Moreover, the Master Mechanics' Association has to a certain extent stood sponsor for it in taking advantage of and following up the Ryerson scholarships. There has now been enough experience so that the Master Car Builders' and Master Mechanics' Associations ought to be in position to investigate the matter thoroughly and make positive recommendations at the next annual convention.

JOE TAYLOR RE-ELECTED SECRETARY

The executive committee of the M. C. B. and M. M. Associations before leaving Atlantic City, re-appointed Joseph W. Taylor secretary for the coming year.

CHARLES H. JENKINS

Charles H. Jenkins, vice-president of the Moran Flexible Steam Joint Company, Louisville, Ky., died suddenly of neuralgia of the heart at Atlantic City on Thursday morning, June 21, at 4.30 o'clock. Mr. Jenkins had been connected with the Moran company for thirty-five years and this was the twenty-sixth of these conventions he had attended. Mrs. Jenkins and Mrs. Thomas W. Moran, who always came with him, have been active in the social events connected with these meetings for several years. Mr. Jenkins was treasurer of the Fourth Ave. Methodist Church at Louisville and a member of its board of stewards. He is survived by Mrs. Jenkins and a daughter, Mrs. Samuel Mengel, of Louisville. The body will be taken to Louisville by Charles R. Long, Jr.

APPRENTICESHIP ON RAILROADS*

By F. W. Thomas.

Supervisor of Apprentices, Atchison, Topeka & Santa Fe.

The National Association of Corporation Schools is an association of men engaged in the training of men for service. Its existence is based on the necessity of better trained help for the large corporations, or other employers of large numbers of people. The constitution states that the object is to aid corporations in the education of their employees, first, by providing a forum for the interchange of ideas, and second, by collecting, and making available, data as to successful and unsuccessful plans in educating employees.

Industrial corporations are realizing more and more the importance of education in the efficient management of their business. The company school has been sufficiently tried out as a method of increasing efficiency to warrant its continuance as an industrial factor. The National Association of Corporation Schools aims to render new corporation schools successful from the start by warning them against the pitfalls into which others have fallen, and providing a forum where corporation school officers may interchange experiences. The control is vested entirely in the member corporations, thus admitting only so much of theory and extraneous activities as the corporations themselves feel will be beneficial and will return dividends on their investment in time and membership fees.

A central office is maintained where information is gathered, arranged and classified regarding every phase of industrial education. This is available to all members who now maintain or desire to institute educational courses. The functions of the association are threefold: to develop the efficiency of the individual employee; to increase efficiency in industry; to have the courses in established educational institutions modified to meet more fully the needs of the industry. The Pennsylvania Railroad, the Southern Pacific, and the Santa Fe railways as corporation members, and a number of other roads are represented through individual or personal membership.

This organization has spent a good deal of time and money in ascertaining the particular features of all the corporation schools in the country, and has codified these and is in a position to assist any corporation, railroad or manufacturing plant, in the establishment of a scheme whereby its employees may be better trained. It is a clearing house for all matters pertaining to any scheme whereby the employer wishes to improve the quality of his help.

At its recent meeting in Pittsburgh 250 were present, rep-

*From an address at the closing session of the Master Mechanics' Association calling attention to the work of The National Association of Corporation Schools.

resenting the industrial and railroad corporations. The committee on Trade Apprenticeship exhibited a mass of interesting figures showing what the railroads and others are doing towards training their future workmen. I have not the time to relate what the industrial corporations have accomplished. I know you are more interested in what the railroads have done. Look into the New York Central, the Southern Pacific, the Pennsylvania, the Grand Trunk, and the Erie apprenticeship systems.

I want to tell you what we have accomplished on the Sante Fe, where we have a modern system of educating and training mechanical apprentices. It is an apprentice system modeled after G. M. Basford's ideas, which he has on so many occasions preached to you. We have been running this system since the fall of 1907. We have graduated into our ranks 850 young mechanics, 72 per cent of these being in service today. We are graduating into our ranks now at the rate of 175 trained mechanics each year—all loyal, skilled, strong, vigorous, young men. Our apprentice system is practically supplying our demands for skilled men. The Topeka shop, which is the largest on the system, enjoys a distinction which no other shop in the whole country can lay claims. *It has not employed a machinist for two years.* That shop is a busy place just now, working a full force during the day. One year from this date the Sante Fe will not have to go on the outside for any of its mechanics, even at the far western desert points. Its apprentice system has furnished us from the ranks all the draftsmen employed in the mechanical engineer's office, the piece work or bonus inspectors, our shop and roundhouse foremen, and pilots for the federal valuation work.

Our apprentice system was never intended to be a money maker. It was not established on mercenary or financial grounds, but was intended as a recruiting scheme to fill our shops with skilled, well trained young workers. It has not been a burden, for any well ordered apprentice system will be self-sustaining.

I know you are spending a good deal of time, of money, and of brains in developing shop tools and machines, in designing and perfecting your locomotives and cars, in ways and means for reducing cost and expenses, but we have not done very much throughout this country in training and developing the most important of all our elements, the hand and mind of our help. It must be some comfort to those responsible for the steady output of your shops, and especially keeping your shops filled with good men, that they have a supply coming on, just as fast as you need them, and that you do not have to worry about getting men nor keeping them.

It is a process of man-making that our railroads must address themselves to if they are to expect a higher efficiency of performance on the part of their shop men.

Ten years ago some of the railroads inaugurated a systematic method of training men on the new basis. Since that time the industrial concerns have become very active, long since passing the railroads in this field of preparedness. Today there is scarcely an industrial plant of importance in this country but what has some advanced method of educating and training its young help. It will pay the railroads to keep in closer touch with these industrial concerns, learn their methods and profit by their methods for the development of men. We cannot do very much with our older employees, so far as recruiting goes. We must look to the boy just out of school for our future. We ask you, gentlemen, to look into the National Association of Corporation Schools, help and encourage us in this work of preparedness.

Preparedness is a popular and catching term all over our country. I have noted the demands for a larger army, a more powerful navy, for our sea coast defences to be strengthened. I have noticed with pride that our big engineers, mechanical, civil and electrical, are offering their services in an advisory capacity to the government free of charge. Railroads have been asked what they can do in an emergency towards moving men and supplies. But, gentlemen, no mention has been made as to our preparedness in furnishing mechanics to make the rifles, to build the battleships, manufacture the munitions, to build and operate the motor trucks, to make the tools for the manufacturers of these elements of preparedness, and to make and maintain the necessary transportation facilities, etc. We have not enough skilled mechanics in the country today for our own domestic use during ordinary times. What will all this preparedness talk amount to if we do not have the men to build, to construct, to manufacture and to operate these elements?

The Santa Fe is sending a number of the best products of her apprentice system to the locomotive constructing plants, the big car building companies, the air brake manufacturing plants, to take a post-graduate course, to work in each department, to assimilate the best, the newest they have in organization, operation and production, and then come back home, out in the far west, and transfuse this new mechanical blood into the hundreds of strong, virile, young mechanics she is making. The National Association of Corporation Schools has no other reason for existing, no other motive than to help prepare and equip this industrial army that we need now and which we will need more next year and the years to follow.

TRAP SHOOTING

There were at least 108 shooters from the three associations who enjoyed the sport of trap shooting up to Tuesday evening. It is possible that there were at least 25 more who shot, but who could not be identified. C. A. Hardy, of the Whiting Foundry Equipment, lead by breaking 538 out of 625, with Thomas O'Malley, of the O'Malley-Beare Valve Company, also of Chicago, a close second with 161 breaks out of 200. The trap record was again broken Tuesday with 3,950 targets thrown. The scores follows:

	Per Cent		Per Cent
C. A. Hardy, 538 x 625	86	H. A. Dieffenbach, 36 x 75	48
Thomas O'Malley, 167 x 200	83	H. I. Gormley, 12 x 25	48
Henry Lee, 362 x 450	80	C. H. Bilty, 24 x 50	48
H. W. McGraw, 20 x 25	80	E. L. French, 12 x 25	48
K. R. Hare, 114 x 150	76	H. A. Hamilton, 12 x 25	48
W. E. McCann, 190 x 250	76	B. S. Johnson, 12 x 25	48
E. E. Whitmore, 19 x 25	76	R. L. Kleine, 36 x 75	48
T. C. deRosset, 131 x 175	74	A. E. Herrold, 12 x 25	48
L. E. Endsley, 18 x 25	72	G. H. Lewis, 12 x 25	48
G. L. VanDoren, 18 x 25	72	L. E. Osborne, 12 x 25	48
F. H. Whitney, 18 x 25	72	A. LaMar, 23 x 50	46
J. Purcell, 53 x 75	71	J. A. MacLean, 103 x 225	46
W. H. Bower, 35 x 50	70	F. C. Dunham, 46 x 100	46
A. O. VanDervort, 35 x 50	70	C. R. Mills, 68 x 150	45
C. Hyland, 69 x 100	69	J. E. Epler, 33 x 75	44
V. E. Sisson, 17 x 25	68	R. G. Gilbride, 11 x 25	44
S. Smith, 34 x 50	68	P. J. Mead, 11 x 25	44
D. C. Anderson, 32 x 50	68	W. S. Noble, 22 x 50	44
H. H. Warner, 17 x 25	68	R. L. McLellan, 21 x 50	42
B. H. Grundy, 136 x 200	68	W. Leighton, 9 x 25	36
E. S. Wood, 50 x 75	67	F. S. Wilcoxen, 18 x 50	36
L. B. Valentine, 30 x 50	66	H. A. Nealley, 9 x 25	36
J. D. Lalor, 16 x 25	64	F. H. Thompson, 35 x 100	35
A. S. Lewis, 81 x 125	64	E. C. Lang, 17 x 50	34
E. M. Barnum, 16 x 25	64	J. M. Ryan, 8 x 25	32
H. H. Hibbard, 95 x 150	63	T. L. Limroth, 8 x 25	32
L. V. Stevens, 31 x 50	62	J. Brogan, 7 x 25	28
H. N. Hitchcock, 46 x 75	61	J. H. McCarty, 7 x 25	28
W. G. Ransom, 30 x 50	60	C. C. Seddon, 7 x 25	28
G. H. Chadwell, 15 x 25	60	J. M. High, 20 x 75	27
R. T. Scott, 50 x 25	60	T. J. Leahey, 20 x 175	27
C. C. Hendrick, 44 x 75	59	S. D. Page, 23 x 75	27
H. F. Ayres, 29 x 50	58	C. Ducas, 13 x 50	26
H. H. Gilbert, 29 x 50	58	B. C. Tracey, 11 x 50	22
C. M. Baker, 71 x 125	57	M. C. Beymer, 11 x 50	22
E. F. Baird, 28 x 50	56	A. F. Ashbacker, 5 x 25	20
A. P. Dennis, 28 x 50	56	R. W. Schulze, 5 x 25	20
C. H. Silkman, 28 x 50	56	C. A. Bieder, 4 x 25	16
Max Goodrich, 14 x 25	56	H. B. Chamberlain, 4 x 25	16
F. L. Gormley, Jr., 14 x 25	56	P. M. Elliott, 4 x 25	16
R. E. Kinkead, 28 x 50	56	R. L. Ettenger, 8 x 50	16
Edward Wray, 69 x 125	55	J. R. Flannery, 4 x 25	16
A. W. Stephenson, 60 x 125	55	A. C. Pollock, 5 x 25	16
W. F. Kall, 27 x 50	54	D. F. Giles, 7 x 50	14
J. H. Bendixen, 213 x 400	53	W. F. Bentley, 3 x 25	12
J. M. Coffey, 26 x 50	52	B. C. Hooper, 6 x 50	12
T. H. Endicott, 13 x 25	52	J. H. Beggs, 3 x 25	12
H. A. Hegeman, 52 x 100	52	F. G. Kall, 6 x 50	12
L. A. Hoerr, 13 x 25	52	A. W. Whitford, 3 x 25	12
A. C. Adams, 64 x 125	51	A. T. Dice, Jr., 6 x 75	8
Frank H. Clark, 25 x 50	50	F. T. Hatch, 2 x 25	8
W. R. Parker, 25 x 50	50	E. R. Lemke, 2 x 25	8
R. K. Reading, 100 x 200	50	W. B. Wheeler, 2 x 25	8
R. E. Woolley, 25 x 50	50		

Master Mechanics' Association Proceedings

Closing Session Wednesday, Including Committee Reports With Discussions; Also Election of Officers

PRESIDENT PRATT called the meeting to order at 9.35 A. M. The reports of the Committees on Co-operation with other Railway Mechanical Organizations and Pistons, Valves, Rings and Bushings which were read at yesterday's session were up for discussion. None being offered, Mr. Pomeroy's paper was next considered, and it was suggested that the members submit written discussions to the Secretary to be printed with the paper in the association's annual proceedings. These reports were abstracted in yesterday's *Daily Railway Age Gazette.*

Use of Powdered Fuel in Locomotives

The use of pulverized fuel in locomotive fireboxes has come into prominence only within the past two years and there are at present three locomotives equipped with facilities for burning this form of fuel; but the conditions are such that the committee has presented this year only a progress report. Sufficient experience will undoubtedly be had during the coming year so that it will be possible to present accurate data as to the performance of pulverized fuel locomotives at the next convention.

The first locomotive equipped to burn pulverized fuel was on the New York Central and as C. H. Hogan, chairman of the committee, is assistant superintendent of motive power of this road, he is particularly fitted to head a committee to report on this subject. E. W. Pratt, assistant superintendent of motive power of the Chicago & North Western, is also a member of the committee, and this road has had an Atlantic type locomotive in service for some time burning pulverized fuel. The Delaware & Hudson is the first road to build a locomotive designed especially for burning pulverized coal, and J. H. Manning, superintendent of motive power, is also a member of the committee. The other members are: Charles James, master mechanic, Erie; W. H. V. Rosing, special engineer, St Louis & San Francisco; Thomas Roope, superintendent of motive power, Chicago, Burlington & Quincy, and George L. Fowler, consulting engineer.

C. H. Hogan, Chairman

THE problems to be encountered in the use of powdered fuel in locomotives are more serious than in stationary practice on account of the necessity for storage of powdered fuel and the limited restrictions of space available on a locomotive.

The first application of such a device for burning powdered fuel on a steam locomotive was made about a year ago, and special apparatus had to be designed, tested, improved and perfected to make it adaptable to locomotive practice, therefore discouragement should not be felt because in so short a time there are not a large number of locomotives in regular successful service burning powdered fuel. None better than the members of this Association know the great difference in the burning of run-of-mine coal from different sections of this country, and even different mines in the same section; therefore they will readily appreciate at least that similar difficulties must be encountered and overcome in burning in powdered form the same coals containing various amounts of moisture, ash, etc., besides the added process of actually pulverizing the fuel.

Perhaps most would agree to-day that but for the difficulty in obtaining fuel oil, and its excessive cost, its use would be much greater than it is; nor is the end of increased cost of oil in sight, since methods have been devised for producing gasoline from it; hence it is believed that the perfection of apparatus for burning powdered fuel with equal advantage offers an acceptable substitute, and on account of the greater supply of coal and its smaller cost, particularly the smaller sizes, many of which at present are entirely wasted, the field for the use of powdered fuel would appear to be much more

extensive. The results to be obtained from successful use of pulverized fuel in locomotives may be summarized as follows:

Operation free from smoke, cinders and sparks; ready maintenance of fuel boiler pressure, increased boiler efficiency, decreased fuel cost, saving of manual labor in stoking, elimination of grates, as well as ash pit delays and expense.

The New York Central locomotive, being the first engine equipped for burning powdered fuel, has been used chiefly for the development and improvement of apparatus necessary for supplying powdered fuel to the firebox and in drafting the locomotive. This is a ten-wheel superheater engine, and has been used in helper and in freight service. The following are the leading characteristics:

Weight on drivers, 158,000 lb.
Tractive effort, 31,000 lb.
Cylinders, 22 by 26 in.
Driving wheels, 69 in. diameter.
Boiler pressure, 200 lb.
Grate area, 54 sq. ft.
Superheating surface, 540 sq. ft.
Total boiler heating surface, 3,188 sq. ft.

The Chicago & North Western locomotive, equipped less than a year ago, is an Atlantic type engine, superheated, and of the following general description:

Weight on drivers, 96,000 lb.
Tractive effort, 21,850 lb.
Cylinders, 20 by 26 in.
Driving wheels, 81 in. diameter.
Boiler pressure, 185 lb.
Grate area, 46.3 sq. ft.
Superheating surface, 428 sq. ft.
Total boiler heating surface, 2,187 sq. ft.

This engine has been used in regular local and through passenger service, and a comparative test made with a duplicate engine burning coal on grates has thus far proved favorable to the powdered fuel, especially in saving fuel in firing up, movement at terminals, dead time, etc. This can readily be appreciated when it is recalled that on most locomotive coal tests it has been found that about 20 per cent was used for work other than while pulling the train, or left in the firebox at the end of the run.

The Delaware & Hudson Company has just received from the builders a consolidation type locomotive equipped for the burning of powdered fuel, the following being a general description of same:

Weight on drivers, 267,500 lb.
Tractive effort, 61,400 lb.
Cylinders, 27 by 32 in.
Driving wheels, 63 in.
Boiler pressure, 195 lb.
Grate area, 99.8 sq. ft.
Superheating surface, 793 sq. ft.
Total boiler heating surface, 3,814 sq. ft.

It was hardly to be expected that the committee would be able to render at this time a comprehensive or conclusive report on the burning of pulverized fuel in locomotives, a matter so new to the art in locomotive practice; however, its members wish it understood that not a little advancement has taken place in this very short period of time and they respectfully submit the above merely as a report of progress and ask for the continuance of the committee.

DISCUSSION

C. D. Young (Penna.): We have been experimenting with powdered fuel for locomotive boilers for about 2½ years and so far our results have not been as gratifying as apparently would be indicated by the progress being made on other roads. Our difficulty seems to be confined so exclusively to regulation of the fire that I wonder just how this is taken care of in road operations. We have also found limitations in the grade of the fuels in regard to moisture and the sulphur in the fuel. Our experiments seem to indicate that you cannot operate free from smoke at high evaporative rates. It seems to be a good deal like oil burning. If you are going to increase the normal overload capacity of the heating surface, you must expect some smoke with it, and when you get the smoke, you do not get the economy you would like to have. Our experiments have been on the locomotive boilers standing still, the boiler being rigged up as in the case of the Coatesville tests made by the Jacobs-Schupert people for the relative heating value of the firebox and tube heating surfaces. I would like to know if experiments on the road indicate that the cost of maintaining, and the additional arch brick combustion chamber will not more than offset the cost of maintaining the grates, and something will have to be done with the slag which accumulates either in the firebox flue sheet or the slag well in the lower part of the combustion chamber. I certainly think this committee should, in view of the activity of this art, be continued, and probably made a standing committee.

J. H. Manning (D. & H.): We have had our powdered coal engine in service for the past three months. We started out with the idea that we could burn 100 per cent anthracite coal, but we found very promptly that we could not do that, for the coal was too low in volatile, and the result was that when it went out it would stay out. We have succeeded, however, in burning very successfully a mixture of 55 bituminous and 45 anthracite, and we hope to be able to reverse that, to burn 55 anthracite and 45 bituminous. We have made no particular scientific tests as to the amount of coal that we could burn per hour, but we have in working the engine to her approximate capacity burned in the neighborhood of 6,000 lbs. per hr. very nicely and successfully.

We operated the engine on a division where we have from 0.4 to 1.6 per cent. grade, ranging from 4 miles long to 19, and in the last 30 days the engine has been in continuous service from 5 to 9 hours per day, without giving us any trouble whatever with any accumulation on the flues, and we feel now that we have got the machine so that our trouble is practically eliminated. The anthracite coal we use is a cullom coal that runs about 75 or 76 per cent. in carbon, 17 per cent. ash, and a low percentage of volatile. It is therefore necessary to boost that volatile up with bituminous coal,

C. W. Corning, (C. & N. W.): The gentleman from the Pennsylvania brought up some of the main points asked quite frequently; in fact, that is most all of the question there is to it, the cost of maintaining the arch relative to the cost of the maintenance of the grates. The Northwestern engine has the original brick work in the combustion chamber that she got when she came out of the shops on August 8th, last year. The arch is the second one, or I would say it is the second one and half of another one: there were two bricks down near the front end that were inclined at first to burn through, and by trying to get those good bricks out of the center, we broke one arch pretty well up, and it fell to pieces; but the last time we took it out, it went back very easily and nicely.

So far as the smoke is concerned the only semblance of smoke is when you first start out; that is more in the form of a dust. After you have run a while, perhaps a mile, that gradually disappears. When the engine has been worked, say for 15 or 20 miles, you will notice but very little discoloration, if any, from the stack. After you have gone 30 miles there is absolutely nothing coming from the stack, except the exhaust steam. At the present time we don't care to store more than ten or fifteen tons for any length of time. We experimented with North Dakota lignite having 1.8 per cent in moisture, 47.25 per cent in volatile, 4.91 per cent in fixed carbon, 9.32 per cent in ash, .72 per cent in sulphur, and 10,960 B. t. u. You can see, gentlemen, that stuff will burn and it burns very successfully. It has one peculiarity, it is not as heavy a coal as the other. You can apply all the three burners at the highest speed of the feeding apparatus or conveyors and you will not see any smoke to amount to anything from the stack; it is more of a yellow dust; it is consumed as fast as you put it in there only it is a little bit harder to handle on account of being so high in volatile; it flashes very quickly. We are running the engine on a first-class passenger train, and the engine does give you more

steam than we want, and the control is perfect. It is not hard to learn to operate a powdered fuel burning engine; in fact, I can educate a fireman in the first six miles out of Chicago, and it takes about 12 minutes to make that. I can have the fireman so that I can turn my back to him and let him handle the engine as a firing apparatus, all alone.

D. F. Crawford, (Penna. Lines): I do not quite understand the cause of the limitation of 10 to 15 tons in storing.

Mr. Corning: It gets hot; and the pulverizing plants can now give you the coal, as I understand it, almost as fast as you want it. Of course, it is not policy, if you have a number of engines, to depend on the one pulverizing plant to supply that coal. If you keep that coal passing continuously through the storage tank, and keep it moving, it is all right. In the steel mills they have a number of tanks where they move it every so many hours; just disturb it.

Mr. Crawford: What I wanted to get was an idea of what this kind of a device would mean to me in my situation with 100,000 to 150,000 tons of coal a day to be handled. It looks as if one big part of the problem is not how to burn it on the locomotive, but how to get it to put it on the locomotive, and to keep it ready.

W. L. Kellogg (M. K. & T.): We have equipped a stationary plant for burning powdered fuel and it has been in operation for about two or three weeks. We propose to make a series of tests of different coals, and the tests being run this week are with the lignite coal. We have also ordered the equipment for locomotives and we will probably have them equipped the latter part of next month.

H. T. Bentley (C. & N. W.): I do not want to detract from the good work that the New York Central lines have done in the experimental test of developing the engine, but I certainly want to give credit to the Chicago & Northwestern Railroad for making the first application for burning pulverized fuel. About 15 years ago we fitted up an engine for burning pulverized fuel, which ran between Chicago and Clinton. We had a very crude arrangement, and it was so very unsatisfactory that we had to abandon it. In regard to the burning out of the brick mentioned by Mr. Young; with an impinging flame on the brick work, there is no question that the brick would burn out very rapidly, but with the lazy flame that is obtained in the engine on the Northwestern Railway, as stated by Mr. Corning, there is very little wear on the brick, and the fact we have had only, I think, two sets of brick in the arch and none in the pan, indicates that the flame is not severe on the brick work.

One thing has been very noticeable—when we equipped this engine and put an old firebox in it we thought we would have considerable trouble, such as we experienced with the oil burning engines, but after nine months of service we find that the firebox is practically in as good condition as the day it was equipped for burning the pulverized fuel. As explained by Mr. Corning when the firebox is cold, there is some slight smoke given off, but as fast as the bricks get hot, that is eliminated entirely. One thing which is very noticeable is the fact that as soon as you get to the engine house and you have taken coal and water, you can go right into the round house without any delays on the clinker pit.

In regard to the storage of pulverized coal, I believe that Mr. Corning did not make himself sufficiently clear on that subject. I believe you can store almost any amount you want to, but you must keep it circulating—you should not have a large volume of pulverized coal stored in the tank, and leave it there for four or five days, and not use any of it, and then expect to find it in satisfactory condition. You can store as much pulverized coal as you want to store, and have as large capacity driers and pulverizers as you think are necessary, as long as you keep the coal in circulation by using it. Under those conditions I do not think you will have any trouble. We have three burners on our engine, and when working very hard, we can use all three burners if it is necessary to do so. But when the engine is standing still, or is running very light, it is possible to use only one burner and it will take care of the requirements. When we first obtained the engine, we had three 3-in. safety valves on it, and the engine made steam very freely with one burner going. We found that the three 3-in. safety valves would not relieve it without the pressure running up to 30 or 40 lb. above the proper pressure for carrying. We then put in three 3½ in. safety valves which improved the condition materially, but still would not relieve the pressure in accordance with the requirements of the government, and we finally had to put three 4-in. safety valves. These took care of the steam very nicely. These 4-in. valves are on the largest type freight locomotives we have on the road.

Alonzo G. Kinyon, (Powd. Coal Eng. & Equip. Co.): Mr. Crawford brought up the question first of the possibility of storing large quantities of pulverized coal. In the process of preparing the coal it is necessary to heat it, of course, to dry the moisture out of it. Consequently the coal goes to the pulverizer at a high temperature, and the act of pulverizing it does not in all cases lower that temperature, so that the coal is delivered to the container at a comparatively high temperature. That difficulty of storing large quantities of coal has been overcome in some of the large pulverized coal installations in metallurgical work by allowing an interval of time between the drying and pulverizing, for the coal to cool off, resulting in the ability to store somewhat large quantities of coal for several days without danger of spontaneous combustion. I believe that is a fact that will be taken care of beyond any question by the arranging at the drying and pulverizing station to cool the coal off between the drying and pulverizing period.

Mr. Crawford also asked in regard to the tendency in burning large quantities of pulverized coal to burn out the brick work in the firebox. I think that will be taken care of in this way: the ultimate success in handling pulverized coal depends entirely upon the thoroughness with which the coal and the air are mixed, before or after, whichever the process may be, its introduction in to the firebox. Students of combustion know in order to have any fuel burned each molecule of the fuel must be intimately in touch with the proper amount of oxygen, and a failure to have this intimate association of the oxygen with the fuel results in inefficient combustion, so that the matter of vital importance is to see that the coal and air are properly mixed or carbonized.

In the metallurgical furnace we have the application of static pressure at the burner, and through this burner the air for the proper burning of the pulverized coal is introduced. The pressure at the burner is 0.1 in., measured in the water, and at the stack the pressure is 0.1 in. vaccum, measured in the water, so that the differential which moves the gases through that burner is 0.2 in., and yet in spite of that we have no difficulty in forcing a flame out of the stack to a distance of 50 ft.

It would be foolish to say that the long flame is produced by this pressure. But what does happen is this: there are millions of minute explosions occurring within the 12 in. of the burner in the combustion of these molecules of fuel, the intimate association of the air and coal admits of this, a movement is given to the flame through the expelling force developed in the combustion of the fuel, and this force seems to spend itself within a few feet from the burner and results in a lazy flame through the balance of the flameway.

The furnace which I have in mind has been in use since last December, and the lining is practically intact, in fact, it looks as if it would last almost indefinitely. The surface is slagged over and it seems to accumulate a certain amount of slag, or it did, but from a period soon after the beginning of the operation of the furnace, the slag is deposited in the bottom of the furnace.

Another point in connection with the use of pulverized coal in locomotives, or all application of its use, is the difficulty of taking care of the slag. This difficulty is proportionate to the chemical make-up of the ash of the coal. Ash which will fuse at low temperatures are especially troublesome. In this intense burning, as we call it, the instantaneous combustion brought about by the thorough mixing of the coal and air we get our higher temperatures within a few inches of the burner, and consequently the fusion of the ash commences instantly. As soon as fusion takes place they collect together and finally get enough weight to drop to the bottom. If we can commence this fusion of ash early in the movement of our flame it will be easier to take care of the slag proposition, and in this furnace of which I speak we precipitate all of the slag within 6 ft. of the burner; beyond that point nothing but light ash is found. The furnace of which I speak is used in metallurgical work.

Mr. Corning: A gas analysis on the Chicago & Northwestern locomotive runs 15 per cent CO_2 without the presence of CO working at its hardest. In fact, you can do that four or five or six times in succession. The temperature of the smoke box is 450, the average. The highest we have ever gotten is 475. You can compare that with your hand-fired locomotive, and I think you will find that your smoke box temperature is 750 to 800.

H. T. Bentley: I move that this committee be made a standing committee of this association.

(The motion was duly seconded, put to vote and carried.)

Specifications and Tests of Materials

The Committee on Specifications and Tests of Materials has done this year and in previous years an enormous amount of work which is of the greatest benefit to the Association. Its membership is representative and the specifications embodied in its reports when presented are the unanimous opinion of the members. The preparation of these specifications requires much hard work as well as the harmonizing of conflicting views, and the greatest evidence that the members could show of their confidence in the committee's work would be the general adoption and use of the specifications. The committee has worked in agreement with the American Society for Testing Materials on specifications for engine truck axles and also on those for boiler and arch tubes. It is intended in the coming year to revamp the old specifications which have not already been gone over and bring them into conformity with the new ones.

C. D. Young, engineer of tests of the Pennsylvania Railroad, is chairman. The other members of the committee are: H. E. Smith, chemist, New York Central; L. S. Randolph, A. H. Fetters, mechanical engineer, Union Pacific; H. B. MacFarland, engineer of tests, Atchison, Topeka & Santa Fe; J. R. Onderdonk, engineer of tests, Baltimore & Ohio; N. E. Sprowl, superintendent of motive power, Atlantic Coast Line; Frank Zeleny, engineer of tests, Chicago, Burlington & Quincy.

THE committee recommends:

(a) That the specifications of the following material, taken from the M. C. B. Association, be submitted to letter ballot as Recommended Practice: Steam Heat Hose; Air Brake Hose; Air Brake Hose Gaskets; Bar Iron; Chain; Pipe; Journal Bearings for Engines and Tenders; Mild Steel Bars, and Tank and Underframe Rivet Steel and Rivets. Also Specifications for Bronze Bearings, as shown by Appendix *A*; Specifications for Locomotive Rivet Steel and Rivets, as shown by Appendix *B*; Specifications for Staybolt Iron, as shown by Appendix *C*; Specifications for Engine Bolt Iron, as shown by Appendix *D*; Specifications for Machine Bolts and Nuts; Specifications for Carbon Steel Bars for Railway Springs; Specifications for Blooms, Billets, and Slabs for Carbon Steel Forgings, as shown by Appendix *E*, and Specifications for Lap-Welded and Seamless Iron and Steel Boiler Tubes, Arch Tubes, Superheater Pipes, and Safe End Material, as shown by Appendix *F*.

[NOTE.—The Specifications for Machine Bolts and Nuts, and for Carbon Steel Bars for Railway Springs are practically the same as those presented to the M. C. B. Association last week.—EDITOR.]

(d) That the Specifications for Foundry Pig Iron, shown on page 516, M. M. 1915 Proceedings, be revised, as shown by Appendix *G*.

(e) That the following Specifications be advanced from Recommended Practice to Standard Practice: Specifications for Steel Castings for Locomotives; Specifications for Quenched and Tempered Alloy Steel Forgings, and the Specifications for Quenched and Tempered Carbon Steel Axles, Shafts, and other Forgings for Locomotives and Cars.

(f) That the Specifications for Steel Axles for Locomotive Tenders, as shown on page 487, M. M. 1915 Proceedings, be modified in accordance with Appendix *H*.

The greatest assistance to the committee by the members will come about through the members using the new Standard and Recommended Practice Specifications.

APPENDIX A

SPECIFICATIONS FOR BRONZE BEARINGS

1. *Scope.*—These specifications cover Phosphor Bronze and Soft Bronze driving boxes and shells, rod bushings, rod brasses and shoes, and liners for locomotives.

I. CHEMICAL PROPERTIES AND TESTS

2. *Chemical Composition.*—The material shall conform to the following requirements as to chemical composition:

	Phosphor Bronze.	Medium Bronze.	Soft Bronze.
Copper, not over, per cent....	82	77	65
Tin, not less, per cent.......	8	7	4
Phosphorous, per cent.......	0.7— 1.0	0.2— 0.6	..
Lead, per cent..............	8.0—13.0	14.0—20.0	26—33
Other Elements and Impurities, not over, per cent....	1.0	1.0	1.0

3. *Analysis.*—The sample for chemical analysis shall be taken from the bearing at three points along the fractured surface, as described in Section 4, either by drilling or by using cuttings thus obtained, well mixed.

II. PHYSICAL PROPERTIES AND TESTS

4. *Tests.*—The finished casting representing a lot for acceptance shall be broken without nicking, in order to ascertain the uniformity of the grain of the metal. When this fracture shows separation or imperfect mixing of component parts and dross or dirt spots, the lot shall be rejected.

5. *Number of Tests.*—Bearings shall be divided into lots of 100 or less and one bearing shall be taken for test and chemical analysis from each lot.

APPENDIX B

SPECIFICATIONS FOR LOCOMOTIVE RIVET STEEL AND RIVETS

1. *Scope.*—This specification covers bars and finished

rivets for locomotive boilers. For tanks and underframes see specifications covering this class of rivets.

A. Requirements for Rolled Bars

I. Manufacture

2. Process.—The steel shall be made by the open-hearth process.

II. Chemical Properties and Tests

3. Chemical Composition.—The steel shall conform to the following requirements as to chemical composition:

Manganese	0.30—0.50 per cent
Phosphorus, not over	0.04 per cent
Sulphur, not over	0.045 per cent

III. Physical Properties and Tests.

7. Tension Tests.—(a) The bars shall conform to the following requirements as to tensile properties:

Tensile Strength, lb. per sq. in	45,000—55,000
Yield Point, min. lb. per sq. in	0.5 tens. str.

Elongation in 8 in. min. per cent $\frac{1,500,000}{\text{Tens. str.}}$ but need not exceed 30 per cent.

(b) The yield point shall be determined by the drop of the beam of the testing machine.

8. Bend Tests.—(a) *Cold-bend Test.*—The test specimen shall bend cold through 180 deg. flat on itself without cracking on the outside of the bent portion.

(b) *Quench-bend Test.*—The test specimen, when heated to a light cherry red as seen in the dark (not less than 1200 deg. F.), and quenched at once in water the temperature of which is between 80 deg. and 90 deg. F., shall bend through 180 deg. flat on itself without cracking on the outside of the bent portion.

9. Test Specimens.—Tension and bend-test specimens shall be the full size section of bars as rolled

10. Number of Tests.—(a) Two tension, two cold-bend and two quench-bend tests shall be made from each lot, each of which shall conform to the requirements specified.

(b) When accurate account of the material has been kept and it is presented as complete melts, only one of the physical test specimens for each diameter shall be taken from the bars or finished rivets for each melt.

(c) If any test specimen develops flaws, it may be discarded and another specimen submitted.

(d) If the percentage of elongation of any tension test specimen is less than that specified in Section 7 (a) and any part of the fracture is outside the middle third of the gage length, as indicated by scribe scratches marked on the specimen before testing, a retest shall be allowed.

B. Requirements for Rivets

I. Physical Properties and Tests.

18. Tension Tests.—The rivets, when tested, shall conform to the requirements as to tensile properties specified in Section 7, except that the elongation shall be measured on a gage length not less than four times the diameter of the rivet.

19. Bend Tests.—The rivet shank shall bend cold through

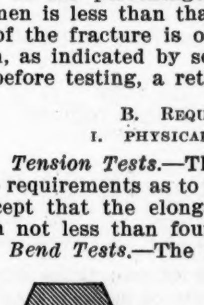


Fig. 1.

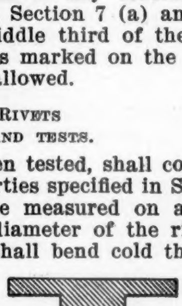


Fig. 2.

Bend and Flattening Tests for Rivet Steel

180 deg. flat on itself, as shown in Fig. 1, without cracking on the outside of the bent portion.

20. Flattening Tests.—The rivet head shall flatten, while hot, to diameter 2½ times the diameter of the shank, as shown in Fig. 2, without cracking at the edges.

21. Number of Tests.—(a) When specified, one tension test shall be made from each size in each lot of rivets offered for inspection.

(b) Three bend and three flattening tests shall be made from each size in each lot of rivets offered for inspection, each of which shall conform to the requirements specified.

APPENDIX C

Specifications for Staybolt Iron

1. Scope.—This specification covers all staybolt iron for locomotives.

I. Manufacture

2. Process.—The iron shall be rolled from a bloom or boxpile, made wholly from puddled iron or knobbled charcoal iron. The puddle mixture and the component parts of the bloom or boxpile shall be free from any admixture of iron scrap or steel.

3. Definition of Terms.—(a) *Bloom.* A bloom is a solid mass of iron that has been hammered into a convenient size for rolling.

(b) *Boxpile.*—A boxpile is a pile, the sides, top and bottom of which are formed by four flat bars and the interior of which consists of a number of small bars the full length of the pile.

(c) *Iron Scrap.*—This term applies only to foreign or bought scrap and does not include local mill products free from foreign or bought scrap.

II. Physical Properties and Tests

4. Tension Tests.—(a) The iron shall conform to the following requirements as to tensile properties:

Tensile Strength, lb. per sq. in	47,000—52,000
Yield Point, min. lb. per sq. in	0.6 tens. str.
Elongation in 8 in. min. per cent	$\frac{1,400,000}{\text{tens. str.}}$
Reduction of Area, min. per cent	48

(b) The yield point shall be determined by the drop of the beam of the testing machine. The speed of the cross-head of the machine shall not exceed 1½ in. per minute.

5. Bend Tests.—(a) *Cold-bend Test.* The test specimen shall bend cold through 180 deg. flat on itself in both directions without fracture on the outside of the bent portion.

(b) *Quench-bend Test.*—The test specimen, when heated to a yellow heat and quenched at once in water the temperature of which is between 80 deg. and 90 deg. F., shall bend through 180 deg. flat on itself without fracture on the outside of the bent portion.

(c) *Nick-bend Test.*—The test specimen, when nicked twenty-five per cent around with a tool having a 60-deg. cutting edge, to a depth of not less than eight nor more than sixteen per cent of the diameter of the specimen, and broken, shall show a clean fiber entirely free from crystallization.

(d) Bend tests may be made by pressure or by blows.

6. Etch Test.—The cross-section of the test specimen shall be ground or polished, and etched for a sufficient period to develop the structure. This test shall show the material to have been rolled from a bloom or a boxpile, and to be free from steel.

7. Test Specimens.—All test specimens shall be of the full section of material as rolled.

8. Number of Tests.—(a) Bars of one size shall be sorted into lots of 100 each. Two bars shall be selected at random from each lot or fraction thereof, and tested as specified in Sections 4 and 5; but only one of these bars shall be tested as specified in Section 6.

(b) If any test specimen from either of the bars originally selected to represent a lot of material, contains surface defects not visible before testing but visible after testing, or if a tension test specimen breaks outside the middle third of the gage length, one retest from a different bar will be allowed.

(c) When retests as specified in paragraph (b) are not permitted, a reduction of two per cent in elongation and three per cent in reduction of area from that specified in Section 4 (a) shall be allowed.

APPENDIX D

Specifications for Engine Bolt Iron

1. Scope.—These specifications cover all wrought iron used in the manufacture of engine bolts.

I. Manufacture

2. Process.—The iron shall be made wholly from puddled iron and shall be free from any admixture of iron scrap or steel.

3. Definition of Terms.—This term applies only to foreign or bought scrap and does not include local mill products free from foreign or bought scrap.

II. Physical Properties and Tests

4. Tension Tests.—(a) The iron shall conform to the following requirements as to tensile properties:

Tensile Strength, lb. per sq. in	50,000—54,000
(See Section 5.)	

Yield Point, min. lb. per sq. in.	0.6 tens. str.
Elongation in 8 in. min. per cent	25
Reduction of Area, min. per cent	40

(b) The yield point shall be determined by the drop of the beam of the testing machine. The speed of the cross-head of the machine shall not exceed 1½ in. per min.

5. *Modifications in Tensile Strength.*—For material over 1¼ sq. in. in section, a deduction of 2000 lb. per sq. in. from the tensile strength specified in Section 4 shall be made.

6. *Bend Tests.*—(a) *Cold-bend Test.*—The test specimen shall bend cold through 180 deg. around a pin the diameter of which is equal to the diameter of the specimen, without fracture on the outside of the bent portion.

(b) *Hot-bend Test.*—The test specimen, when heated to a bright cherry red, shall bend through 180 deg. flat on itself without fracture on the outside of the bent portion.

(c) *Nick-bend Test.*—The test specimen, when nicked twenty-five per cent. around with a tool having a 60-deg. cutting edge, to a depth of not less than eight nor more than sixteen per cent. of the diameter of the specimen, and broken, shall show a wholly fibrous fracture.

(d) Bend tests may be made by pressure or by blows.

7. *Etch Test.*—The cross-section of the test specimen shall be ground or polished, and etched for a sufficient period to develop the structure. This test shall show the material to be free from steel.

8. *Test Specimen.*—(a) Tension test specimens shall be the full section of material as rolled, if possible. Otherwise, the specimens shall be taken from the material as rolled; for bars 2½ in. or less in diameter, the axis of the specimen shall coincide with axis of the bar; for bars over 2½ in. in diameter, the axis of the specimen shall be located at any point one-half the distance from the center to the surface and shall be parallel to the axis of the bar; and the specimens shall be turned to a diameter of 1 in. for a length of at least 9 in., with enlarged ends.

(b) Bend and etch test specimens shall be of the full section of material as rolled; except that for bars over 1½ in. in diameter, the cold-bend test specimen may be machined to not less than 1 sq. in. in section.

9. *Number of Tests.*—(a) Bars of one size shall be sorted into lots of 100 each. Two bars shall be selected at random from each lot or fraction thereof, and tested as specified in Sections 4 and 6; but only one of these bars shall be tested as specified in Section 7.

(b) If any test specimen from either of the bars originally selected to represent a lot of material, contain surface defects not visible before testing but visible after testing, or if a tension test specimen breaks outside the middle third of the gage length, one retest from a different bar will be allowed.

APPENDIX E

The following specifications supersede Specifications for Blooms and Billets for Locomotives, given on page 515, M. M. 1915 Proceedings:

STANDARD SPECIFICATIONS FOR BLOOMS, BILLETS AND SLABS FOR CARBON STEEL FORGINGS

1.—*Scope.*—(a) These specifications cover five classes of billets, determined by their carbon ranges, as specified in Section 6.

(b) The purpose for which these classes of billets are frequently used are as follows:

Class A—for welding and case hardening.

Class B—for case hardening when subsequently heat-treated.

Class C—for special purposes.

Class D—for axles, shafts, connecting rods and similar forgings.

Class E—for Class D forgings when they are to be heat-treated.

3. *Basis of Purchase.*—(a) Billets shall be puchased as semi-finished, rolled or forged material. In ordering, all dimensions shall be expressed in feet and inches.

(b) Unless otherwise specified, the billets shall be made from ingots of at least four times the sectional area of the billet.

I. MANUFACTURE

4. *Process.*—The steel shall be made by the open-hearth process.

5. *Discard.*—A sufficent discard shall be made from each ingot to secure freedom from injurious piping and undue segregation.

III. CHEMICAL PROPERTIES AND TESTS

6. *Chemical Composition.*—The steel shall conform to the following requirements as to chemical composition:

Elements Considered	Class A	B	C	D	E
Carbon, per cent[2]	0.08—0.18	0.15—0.25	0.25—0.38	0.38—0.52	0.45—0.60
Manganese, per cent	0.30—0.50	0.30—0.50	0.40—0.60	0.40—0.60	0.45—0.70
Phosphorus, max. per cent	0.045	0.045	0.045	0.045	0.045
Sulphur, max. per cent	0.05	0.05	0.05	0.05	0.05

[2]See Section 8 (b).

8. *Check Analysis.*—(a) Analyses may be made by the purchaser from at least one billet representing each melt, which shall conform to the requirements specified in Section 6. Drillings shall be taken from the billet with a ⅝-in. drill, parallel to the axis of the ingot as cast, at any point midway between the center and surface. This analysis shall conform to the requirements specified in Section 6.

(b) In addition to the complete analysis specified in paragraph (a), a carbon determination may be made by the purchaser of drillings taken from the center of the billet with a ⅝-in. drill, parallel to the axis of the ingot as cast, to determine by the variation in carbon the amount of segregation. For grades C, D and E this determination shall show the carbon to be within 12 per cent of the amount found at the midway point.

APPENDIX F

The following specifications for lap-welded and seamless iron and steel boiler tubes, arch tubes, superheater tubes and safe end material supersedes specifications for iron locomotive boiler tubes given on page 506, 1915 M. M. Proceedings, and specifications for lap-welded and seamless steel boiler tubes, safe ends and arch tubes given on page 507, M. M. 1915 Proceedings:

SPECIFICATIONS FOR LAP-WELDED AND SEAMLESS IRON AND STEEL BOILER TUBES, BOILER FLUES, SUPERHEATER PIPES, SAFE ENDS AND ARCH TUBES

1. *Scope.*—These specifications cover all lap-welded and seamless iron and steel boiler tubes, arch tubes, superheater pipes and safe end material for locomotives.

I. MANUFACTURE

2. *Process.*—(a) *Steel.*—The steel shall be made by the open-hearth process.

(b) *Iron.*—The iron shall be made from knobbled, hammered charcoal iron.

II. CHEMICAL PROPERTIES AND TESTS

3. *Chemical Composition.*—The steel shall conform to the following requirements as to chemical composition:

Carbon		0.08—0.18	per cent
Manganese		0.30—0.50	per cent
Phosphorus	not over	0.04	per cent
Sulphur	not over	0.045	per cent

4. *Check Analysis.*—(a) Analyses of two tubes in each lot of 250 or less and of 2000 ft. or less of safe end material may be made by the purchaser, which shall conform to the requirements specified in Section 3. Drillings for analyses shall be taken from several points around each tube.

(b) If the analysis of only one tube does not conform to the requirements specified, analyses of two additional tubes from the same lot shall be made, each of which shall conform to the requirements specified.

(c) Chemical analysis will not be required for charcoal-iron tubes.

III. PHYSICAL PROPERTIES AND TESTS

A—Steel Tubes

5. *Flange Tests.*—(a) For all tubes except superheater pipes, a test specimen not less than 4 in. in length shall have a flange turned over at right angles to the body of the tube, without showing cracks or flaws. This flange, as measured from the outside of the tube, shall be ⅜ in. wide for tubes 2½ in. or under in outside diameter, and ½ in. wide for tubes over 2½ in. in outside diameter.

(b) In making the flange test, it is recommended that the flaring tool and die block shown in Fig. 3 be used.

6. *Flattening Tests.*—(a) For all tubes except superheater pipes, a test specimen 4 in. in length shall stand hammering flat until the inside walls are in contact, without cracking at the edges or elsewhere. For lap-welded tubes, care shall be taken that the weld is not located at the point of maximum bending.

(b) For superheater pipes, a test specimen 4 in. in length shall stand flattening by pressure or hammering until the distance between walls is twice the thickness of the material, without cracking at the edges or elsewhere.

7. Crush Tests.—(a) For all other tubes except superheater pipes, a test specimen 2½ in. in length shall stand crushing longitudinally until the outside folds are in contact, without showing cracks or flaws.

(b) For superheater pipes, a test specimen 2½ in. long shall stand crushing longitudinally down to 1¼ in. without showing cracks or flaws.

8. Hydrostatic Tests.—Tubes under 5 in. in diameter shall stand an internal hydrostatic pressure of 1000 lb. per sq. in. and tubes 5 in. or over in diameter shall stand an internal hydrostatic pressure of 800 lb. per sq. in.

B—Iron Tubes

11. Bend Tests.—(a) *Quench-bend Test.* Strips ½ in. in width by 6 in. in length, planed lengthwise from tubes, when heated to a cherry red and quenched at once in water the temperature of which is 80 deg. F., shall bend in opposite directions at each end, without showing cracks or flaws.

(b) *Nick-bend Test.*—Strips ½ in. in width by 6 in. in

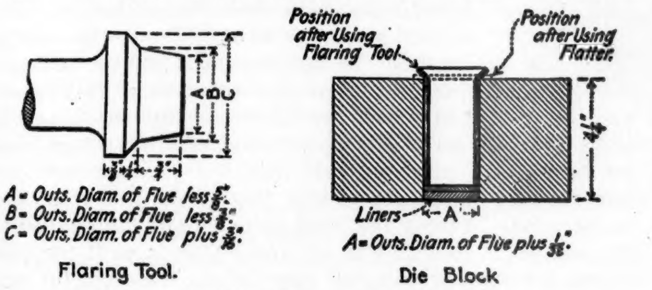


Fig. 3.—Flaring Tool and Die Block for Flange Test of Steel Tubes

length, planed lengthwise from tubes, when nicked and broken by light blows, shall show a wholly fibrous fracture.

12. Expansion Tests.—A test specimen 12 in. in length shall be heated for a length of 5 in. to a bright cherry red (1200-1400 deg. F.) placed in a vertical position, and a smooth tapered steel pin at blue heat (600-800 deg. F.) forced into the end of the tube by pressure or by light blows of a 10-lb. hammer. Under this test the tube shall expand to 1⅛ times its original diameter without splitting or cracking. The pin shall be of tool steel and shall have a taper of 1½ in. per foot of length.

13. Crush Tests.—A test specimen 2½ in. in length shall stand crushing longitudinally to a height of 1⅛ in. without splitting in either direction and without cracking or opening at the weld.

14. Hydraulic Tests.—Each tube shall stand an internal hydraulic pressure of between 500 and 750 lb. per sq. in.

15. Etch Tests.—In case of doubt as to the quality of material, the following test shall be made to detect the presence of steel. A cross-section of tube shall be turned or ground to a perfectly true surface, polished free from dirt or cracks, and etched until the soft parts are sufficiently dissolved for the iron tube to show a decided ridged surface, with the weld very distinct, while a steel tube would show a homogeneous surface.

17. Test Specimens.—(a) Test specimens shall consist of sections cut from tubes selected by the inspector representing the purchaser from the lot offered for shipment. They shall be smooth on the ends and free from burrs.

(b) All specimens of steel tubes shall be tested cold.

18. Number of Tests.—(a) *Steel.*—One flange, one flattening, and one crush test shall be made from each of two tubes in each lot of 250 or less of tubes, or 2000 ft. of safe ends.

(b) *Iron*—Two quench-bend, two nick-bend, one expansion, one crush, and when required, one etch test shall be made from one iron tube in each lot of 250 or less, or 2000 ft. of safe end material.

(c) Each tube shall be subjected to the hydrostatic tests as specified for steel or iron tubes, respectively.

19. Retests.—(a) If the results of the physical tests of only one tube from any lot does not conform to the requirements specified for steel tubes, retests of two additional tubes from the same lot shall be made, each of which shall conform to the requirements specified.

(b) If the results of the physical tests do not conform to the requirements specified for iron tubes, retests of two additional tubes from the same lot shall be made, each of which shall conform to the requirements specified.

APPENDIX G

SPECIFICATIONS FOR FOUNDRY PIG IRON

1. Scope.—These specifications apply to all foundry pig iron which should be bought according to the grades shown by Section 3.

I. MANUFACTURE

2. Process.—The pig iron shall be made in accordance with the best modern practice and may be either sand or machine cast.

II. CHEMICAL PROPERTIES AND TESTS.

3. Chemical Composition.—The pig iron shall conform to the following requirements as to chemical composition:

	No. 1 Foundry Coke Iron.	No. 2 Low Silicon Coke Foundry Iron.	No. 3 High Manganese Coke Foundry Iron.
Silicon, per cent	2.50—3.25	1.00—1.50	1.00—1.50
Manganese, per cent	0.50—1.00	0.50—1.00	1.75—3.00
Phosphorus, per cent	0.50—0.90	0.20—0.70	0.20—0.70
Sulphur, per cent, not over.	0.05	0.05	0.05

Foundry charcoal pig iron will be bought in grades according to the following limits:

Silicon, per cent, maximum variation, any grade	0.25
Manganese, per cent, maximum variation, any grade	0.40
Phosphorus, per cent, not over	0.50
Sulphur, per cent, not over	0.05

6. Sampling.—Ten pigs shall be taken at random from the various parts of each carload or less. These pigs shall be broken in half and from one-half of each pig, the same amount of drillings shall be taken at or near the center by boring parallel to the axis of the pigs. These drillings shall be well mixed and a sample for chemical analysis shall be taken from this mixture.

APPENDIX H

On page 488, M. M. 1915 Proceedings, Specifications for Steel Axles for Locomotive Tenders.

In Section 5, paragraph (a) insert after the word "supports" in the first line, the words "three feet apart."

Omit the table on page 488 and substitute the following table:

NEW TABLE

Weight of Tup, 2,240 Lb.
Supports 3 Ft. Apart.

Size of Axle, In. Journal.	Diameter at Center.	Height of Drop, Ft.	Number of Blows.	Maximum Permanent Set, In.
4¼ x 8	4¾	22½	5	7½
5 x 9	5⅜	29	5	6½
5½ x 10	5⅞	34½	5	5½
6 x 11	6 7/16	41½	5	4½

Insert the following as paragraph (b):

(b) Formula: (1) The above heights of drop were derived from the following formula:

$H = d^2$

H=height of drop in feet.

d=diameter of axle at center in inches.

(2) The above values for maximum permanent set after first blow were derived from the following formula:

$$\text{Maximum permanent set in inches} = \left(\frac{L}{1.9d} - \frac{2}{d}\right) + \frac{3}{4}\text{in.}$$

L=length of axle in inches.

Change paragraph (b) to (c).

NOTE.—The value derived from the above formula for permanent set was 5 in. for the 6 by 11 in. axle, but the allowable permanent set was dropped to 4½ in. as more nearly representing what would be obtained in practice.

DISCUSSION

C. D. Young, (Penna.): I would like to again urge upon the members their attention to the last paragraph of the Committee's report, as it is only through the use of the specifications that we can learn where they are incorrect, and where they should be revised, in order to fully protect the consumer in regard to the quality of the material. Our committee feels that the specifications in their present form will be good commercial practice and material; if purchased and inspected under these specifications to give very satisfactory results in service. I move that the recommendations of the committee be submitted to letter ballot.

G. W. Wilden, (N. Y., N. H. & H.): Referring to the process of manufacture under the specifications for staybolt

iron: if these specifications are strictly adhered to will they not limit the present well known principle of staybolt irons, because of their process of manufacture?

C. E. Seley, (Amer. Flexible Bolt Co.): I would like to join with Mr. Wilden in the question which he raises, as it would appear that by confining the processes to those named in section 2 it would eliminate about half of the staybolt producing plants in the country. I do not propose to champion any method of making staybolt iron, but I do not think it would be wise for the Association to adopt a specification which would make such a radical step as that, as regards manufacture. The question may be raised that by admitting slab piled iron that possibly somebody might improperly pile that iron. It occurs to me that there is also equal opportunity for improper puddled furnace practice, and the other method of piling. I notice that the last words of section 2 reads that "the material should be free from any admixture of iron scrap or steel," and section 3 defines what a bloom is, a box pile, and iron scrap, etc., but does not define steel. We do not expect to use steel staybolts, but in making puddled iron there is the possibility of an admixture of steel, or a steely condition produced in some way or another. In fact, we have had rather disastrous experiences in staybolt iron where the carbon ran too high. Whether this was steel or a steely condition I do not care to say. In any event, it does not make very good staybolt iron.

I do not wish to be considered as advising a chemical test in addition to this specification, although I do believe that the railroads should be guarded against improperly constituted iron, as regards chemical constituents, and it occurs to me that taking the nick-bend test, it gives an opportunity for seeing whether an additional chemical test might be necessary on any particular lot of iron. If you have the break which the committee wishes to get, it would seem unnecessary to go further, but if there is crystallization, there will be an opportunity for the microscope or the chemical test to ascertain what is the cause of that crystalline fracture, and I think it will often be found to be a case of carbon. I approve entirely the change in the tensile tests from the commitee's original limit as sent out in December, as stated by the chairman, and also that if the slab piled iron is permissible under sections 2 and 6, it would be a decided improvement.

Mr. Young: In replying to Mr. Wildin's inquiry, the question of permitting slab piling in staybolt iron: The members of our committee were unanimously opposed to slab piling in staybolt iron, because we do not believe that the iron can be properly heated for proper refinement under that method of piling. Furthermore, all the vibratory results that we have gotten, either on a machine made by Olson, and information as given by Mr. Hunnings of the American Locomotive Works, or the vibratory tests made on the Pennsylvania Railroad testing machine, indicate that you will get low virbatory tests from low heating. The committee feels that they have not got very much information on slab piling, but it does feel that it is not the best way to make staybolt iron, and we are trying to get good staybolt iron which will stand vibratory tests under those specifications. If the advocates of slab piling will present our committee with information during the next year indicating that they can get equally as good results from slab piling as we can from box or bloom piling, I am sure the committee will be very blad to receive that information and give it due consideration and report back at the next convention.

So far as Mr. Seley's criticism that we do not define steel under our definitions, is concerned. This question was not discussed by the committee, but I do not think it is necessary in staybolt iron specification to define steel or other admixtures that may occur in the iron, and that the etch test should be sufficient to determine whether steel scrap has been introduced into the piling.

C. A. Seley: I would like to say for Mr. Young's information that an etch test would probably disclose a steel added in the piling. My remarks referred not only to that, but to a steely condition brought about by an excess of carbon. The ordinary opinion, I believe, as regards the carbon constituent in staybolt iron is that it should not exceed .05 per cent., and I have seen staybolt iron running up to 14 per cent., and unable absolutely to disclose it by test, because with .14 per cent. carbon shown in the general analysis, it was not confined to a spot or a portion which would be disclosed by an etch test.

Mr. Young: I think, in that case it would be rather exceptional to resort to the microscope for commercial staybolt iron, and I suppose that would be done in case of dispute.

Mr. Wildin: Do I understand Mr. Young's motion to include the submission of the specifications for staybolt iron to letter ballot?

The President: I so understand.

Mr. Young: As recommended practice, yes, sir.

Mr. Wildin: I move you as an amendment to that motion that these specifications be deferred until further information is at hand for the committee to make a final report. They admit that they have made but very little study of this, and I am quite sure from my personal experience that I can get better slab piled staybolt iron from certain manufacturers than I would get of iron that would just pass these specifications. I think that until more definite information on this subject is furnished to the committee or until the committee has made a thorough study of the question, the submission of this particular specification should be deferred for another year.

C. B. Smith, (B. & M.); In seconding Mr. Wildin's amendment I would like to add that from my own experience in the use of a slab piled iron of a very well known brand for a great many years, it would certainly be inconsistent for us to vote "yes" in a letter ballot for the adoption of this specification.

Mr. Young: In defense of the committee's recommendation I would like to call the attention of the membership to the fact that this specification was written last fall and sent out in December for criticisms. Of all the criticisms received no objection was made to the specification, so far as the piling was concerned, until some time in the latter part of April, after this report had gone to the printer. It is only being offered as recommended practice, and I have already stated that the committee would be glad to receive information indicating that slab piling is a good thing, because it is cheaper, and if it can be done cheaper we certainly should permit it if it gives good results. I think the committee has been very fair with regard to the specification. The members have certainly had time to give this matter due consideration.

(Mr. Wildin's amendment was carried.)

D. F. Crawford, (Penna. Lines.): I am afraid now that we will have to start over and remove from our recommended practice a great many things that are in just the same condition. I sympathize entirely with what Mr. Wildin has said as to the necessity for investigation to ascertain whether or not we can use slab piled iron or any other kind of iron, but the recommended practice of both the M. C. B. Association and the Master Mechanics' Association contain many things really of more importance than this. I am very sorry that we have withdrawn our support from the committee on a recommended practice. If it was the adoption of a standard, I would fight side by side with Mr. Wildin.

The President: We have a motion before the house that the recommendations of the committee, as amended, be submitted to letter ballot.

(The motion was carried.)

Mr. Crawford: If it is in order I move that this committee be made a standing committee. It seems to me that one of the most important things that can be done for the railways is to have a permanent committee on specifications, who can follow up the development of the work.

(The motion was duly seconded, put to vote and carried.)

Modernizing of Existing Locomotives

The modernizing of existing locomotives has been given considerable attention on a number of roads during the past few years. The committee was appointed last year to investigate this subject, and the report includes all of the information which it was able to collect. While the committee does not feel that the report is nearly complete, it embodies the views of over 30 members of the Association, the summing up of the committee having been based on these views. The conclusions are given in the first part of the report, so that those who wish to get the gist of the report can do so without reading it entirely through. The subjects discussed include conversions of Consolidation engines to Mikados; change of type of engines; superheating saturated steam locomotives; brick arches; outside valve gear, and size of valves.

F. J. Cole, Chairman

F. J. Cole, chairman of the committee, is chief consulting engineer of the American Locomotive Company and has long been known as an authority on locomotive design. The other members are: J. C. Little, mechanical engineer, Chicago & North Western; C. A. Gill, general master mechanic, Baltimore & Ohio; M. J. Drury, superintendent of shops, Atchison, Topeka & Santa Fe; R. D. Hawkins, superintendent of motive power, Great Northern; J. Snowden Bell patent attorney, New York City; D. J. Mullen, superintendent of motive power, Cleveland, Cincinnati, Chicago & St. Louis.

In order to obtain information from railroads as to what had already been done in respect to the way of modernizing existing locomotives, a circular was sent to the members of the Association inquiring as to the character, extent and results of their practice in the direction of modernizing existing locomotives. Thirty-two replies were received to this circular. The conclusions of the committee are as follows:

LENGTH OF TIME AN ENGINE SHOULD BE BUILT IN ORDER TO JUSTIFY MODERNIZING

In this question the matter of what constitutes modernizing should be clearly borne in mind. The track, bridges, etc., have been increased in strength on most railroads, so that higher axle loads and greater total weights can be borne with safety than in previous years. In many instances, however, the capacity, weight and condition of old engines would justify the application of many improvements, such as superheating, etc., which make for economy and increase in capacity.

When consideration is given to the question of changing the type of engines the matter of weight and capacity is the vital issue. Will the engine, after a large amount of money, say 50 per cent of its cost, has been spent, be modern in all respects, and will it perform the work in the most satisfactory and economical manner?

THE CONVERSION OF CONSOLIDATION ENGINES INTO MIKADOS

A great many locomotives have been thus modernized. This change is especially desirable where greater boiler capacity is necessary in maintaining speed and sustained horsepower in cases where the limitation of the engine has been the inability of the boiler to supply the necessary amount of steam. Where Consolidation engines are of large size, with wheels of suitable diameter and ample crank pins and axles, having modern tenders of large capacity, where many other parts can be used to advantage, it is often economy to reconstruct such Consolidations and convert them into Mikados. One leading railroad system has converted between four and five hundred Consolidations into Mikados. The efficiency of its power is thereby materially increased.

Most Consolidations built during the last ten or fifteen years have shallow fire boxes on top of the rear pair of drivers. It is more difficult with such engines, on account of the shallow throat, to equip them in a satisfactory manner with brick arches. When they are converted into Mikados a fire box of any size and depth can be used and brick arches applied in a most satisfactory manner. Flues may be increased in length and smoke-box temperatures may be decreased correspondingly. The longer boilers also permit the use of combustion chambers, if desired. With ample grate surface the rate of combustion can be kept down to reasonable limits and the economy of the engine increased materially.

As a general proposition, a locomotive boiler can not be made too large. It often is made too small. Therefore, one of the most satisfactory means of increasing economy and capacity is to increase the boiler capacity.

CHANGE OF TYPE OF LOCOMOTIVES

As a general proposition, in considering the conversion of type, it is very necessary to make careful study of parts that can be used on the old locomotive, such as wheels, axles, rods, tender, etc., at the same time estimating or obtaining bids from builders as to what the work can be done for. Very careful consideration must also be given to ascertain whether, after the rebuilding has been accomplished, the railroad would be in possession of a really modern engine best adapted to perform the service for which it is intended.

SUPERHEATING SATURATED-STEAM ENGINES

The advantages gained from the use of superheated steam on locomotives are now so widely recognized that no special argument in its favor is necessary in this report. Superheated steam is a much better working medium in steam engines than saturated steam. Superheating affords the only means of adding heat to the steam without increasing its pressure. The economy of highly superheated steam for locomotives is obtained, first, in its freedom from condensation losses in the cylinders and steam pipes; second, from the increased volume of superheated steam per unit of weight. The amount of cylinder condensation in a simple saturated-steam locomotive is estimated to be from 35 per cent at 20½ per cent cut-off, to 12 per cent at 70 per cent cut-off. Assuming that each 1 per cent of moisture will require about 7.5 deg. of superheat to entirely prevent condensation, it follows that with 25 per cent of moisture a

superheat of at least 187 deg. will be required, and more is advantageous.

In considering the advantages of superheated steam for locomotives, two general conditions may be noted: First, the economy in coal and water from the use of superheated steam; secondly, the additional power made available by the more economical operation of the engine. If a simple locomotive, using highly superheated steam, consumes on an average 25 per cent less fuel there will be an increase in indicated horse-power of 33 per cent in favor of the superheater, and the actual gain in tractive power delivered at the drawbar will be even greater than this increase in indicated horse-power. The reason of this is that at the running speeds of trains about 40 per cent of the I. H. P. is absorbed by the internal friction of the engine and tender, leaving only about 60 per cent to be transmitted to the drawbar.

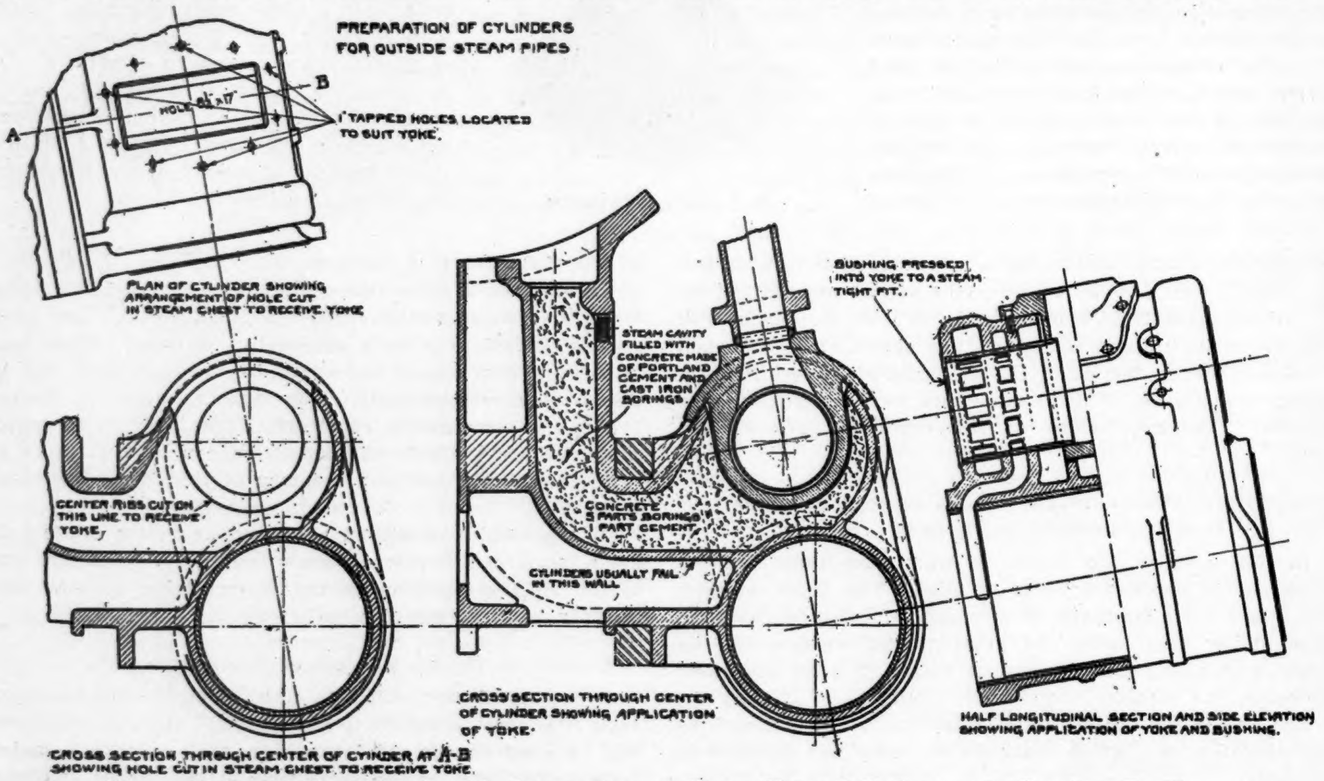


Fig. 1.—Method of Applying Outside Steam Pipes to Piston Valve Cylinders on the Southern Pacific

Consequently an increase of 33 per cent of I. H. P. represents a much greater gain in dynamometer horse-power.

The application, to existing locomotives, of an efficient superheater capable of producing and maintaining a high degree of superheat, is equivalent to a considerable increase in boiler capacity, which is usually equivalent to a large increase in the hauling capacity of a locomotive.

On many railroads records exist showing that with the use of superheated steam several hundred tons of additional hauling capacity can be obtained from the same engines. The limitation of locomotives in many instances is the inability to supply them with coal in sufficient quantities and at the proper time; therefore, any device which reduces the amount of coal necessary to be fed to the furnace is a long step toward improving the general efficiency of the engine.

BRICK ARCHES

On the majority of engines a brick arch, properly installed and maintained in good condition, will produce a substantial saving in fuel, and also, by doing the work with smaller amount of coal, improve the general efficiency of the engine. Probably a saving of about 5 to 10 per cent can often be made by the application of brick arches. The brick arch, by increasing the length of flameway in the fire box and preventing the gases and unburnt coal from entering directly into the boiler tubes before complete combustion has taken place, adds materially to the steaming capacity of the boiler and reduces the amount of coal necessary to be fired. Much benefit will also be derived from its use by preventing the formation of black smoke.

OUTSIDE VALVE GEAR

Few locomotives at the present time are built with the inside or Stephenson valve gear. The outside gears are much easier to lubricate, maintain and inspect. The repairs and maintenance of outside valve gears to keep them in good condition are much easier and cheaper than the Stephenson. Furthermore, the reduced wear of the outside valve gear, by reason of its case-hardened pins and bushings, does not distort the gear to the extent that the wear of the eccentrics and straps does on the Stephenson gear. This is a very important matter, since the outside gear requires but little or no adjustment or resetting of valves.

Another advantage of the outside valve gear is that transverse bracing can be used between the frames to maintain them in proper vertical alignment and also for distributing the stresses.

SIZES OF VALVES

With superheated steam it is possible to use a smaller diameter of piston valve for the same size of cylinders than would be necessary for saturated steam. This is largely on account of the lightness of the superheated steam, which permits it to traverse the passages and ports at a much higher velocity.

The sizes of piston valves used by a prominent locomotive builder in this country are as follows:

Valve Diameter	Cylinder Diameter Saturated Steam	Superheated Steam
10 in.	17 in. to 18 in.	18 in. to 19 in.
11 in.	18½ in. to 20 in.	19½ in. to 21 in.
12 in.	20½ in. to 22 in.	21½ in. to 23 in.
14 in.	22½ in. to 24 in.	23½ in. to 27 in.
16 in.	24½ in. upward	27½ in. upward

Extensive tests were made by the Pennsylvania Railroad on the locomotive testing plant at Altoona to determine the limitations in the use of piston valves varying from 7 to 16 in. in diameter, on locomotives having 22, 24 and 25 in. diameter of cylinders. In all cases these tests were made with

locomotives using superheated steam. The conclusions drawn from these tests led the Pennsylvania Railroad to adopt 12 in. diameter of valves for cylinders between 20 and 27 in. in diameter, and for cylinders 20 in. and less, 8 in. diameter valves. The results of these tests were published in P. R. R. Test Department Bulletin No. 23, 1914. Some of the conclusions drawn from these tests, printed on pages 31 and 32 of that report, are as follows:

"To establish a relation between the valve and cylinder so that the valve may be standardized, it may be stated generally that the diameter of the valve in inches for superheated steam should not be less than $0.016D^2$ where $D =$ the diameter of cylinder in inches. Decreasing the valve diameter on a locomotive necessitates increasing the percentage of cut off to obtain the same power at the same speed. This causes a longer valve travel."

From a maintenance point of view, it is of course desirable and economical for a railroad to carry in stock as few diameters of piston valves as possible. These considerations doubtless led the Pennsylvania Railroad to adopt the 8 and 12 in. valves as standard to be used in new construction and reconstruction wherever possible.

These sizes adopted by the Pennsylvania Railroad are so much smaller than required by current locomotive practice in the United States, that some caution should be observed in adopting them without due consideration.

A novel method of applying outside steam pipes to piston-valve cylinders, used by the Southern Pacific at their Los Angeles shops, is shown in Fig. 1. This consists of cutting a hole 8¾ in. by 17 in. in the upper wall of the steam chest and dropping therein an integral finger-ring bushing fitted and bolted to place and afterward bored out for the bushings. It will be noticed that the only steam-tight joint necessary for this finger-ring casting is where the bushings are pressed in. The fitting between the finger-ring bushing and the outside wall of the steam chest need not be steam-tight; only a solid bearing for bolting is required. The print and description was received from T. W. Heintzelman, general superintendent motive power.

The following is an abstract of the replies received from some of the roads replying to the committee's circular of inquiry:

ATCHISON, TOPEKA & SANTA FE

By M. J. Drury, Superintendent Shops.

I have prepared some data on the conversion of a Consolidation engine into a Mikado type. This engine has a tractive force of 35,500 lb. and has four boiler courses, and, by the proposed changes, applying a twenty-eight unit Schmidt superheater, Baker valve gear, new cylinders and other material, as well as extra course in boiler and new fire box, the tractive force would be increased to 39,450 lb.

CONSOLIDATION LOCOMOTIVE CONVERTED TO MIKADO TYPE

	Direct Labor	Material
New firebox similar to 507 Class	$290.00	$386.00
New cylinders (piston valve)	50.00	855.54
New trailer truck like 3100 Class and new trailer truck radius bar cross tie	50.00	150.00
Spring rigging to be modified to meet addition of trailer truck	15.00	10.00
Trailer frames to be added.		
Main frame to be cut off and arrangements made for bolting on new trailer frames	155.00	90.00
New furnace bearers, front and back	5.00	16.15
Two new air drums	7.50	24.67
New cab bracket	.50	1.75
New firing deck	3.60	1.25
Baker gear	129.32	790.92
Schmidt superheater, 28 units	150.65	1,497.07
New boiler tubes, 158, 21¼ in. and 28 5½ in. all 21 ft. long	39.50	676.12
New front flue sheet	39.00	32.00
New ashpan	42.00	22.00
New grates	5.00	20.00
New steam pipes	15.00	28.00
New rear boiler course	66.00	40.00
Power reversing gear	8.00	6.00
New auxiliary dome	5.00	34.50
Boiler to be raised 5 in. (This necessitates new belly braces)	$25.00	$30.00
Front end of cab to be modified	15.00	32.00
Change tender from 5,000 gallons capacity to 7,000 gallons capacity	175.00	75.00
Direct Labor	$1,291.07	$4,818.97
Surcharge	1,188.96	
Total Labor	$2,480.03	
Material	4,818.97	
Total Cost	$7,299.00	

A detailed list of material is attached which it would take to modernize this engine, giving the direct labor, material and surcharge separate. The total cost to make this change would be $7,299.

CENTRAL OF GEORGIA

By F. F. Gaines, Superintendent Motive Power.

It has never seemed to me advisable or desirable to go to the expense of applying a trailing wheel and make a Mikado out of a Consolidated type engine, as the expense involved is so great, and there are always places where you can use Consolidation engines to advantage with superheaters. I think the better plan is to gradually eliminate the Consolidated type of power and supersede them by superheat engines with piston valve and of the Mikado type. We already have a number of Mikado engines which are giving excellent results, but do not feel warranted in changing our Consolidations to this type.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS

D. J. Mullen, Superintendent Motive Power.

It has been the policy to convert comparatively modern Consolidation engines not more than ten years old, and which were originally equipped with Stephenson gear into Mikado engines. To date all engines of this class, or eighty-nine in all, have been converted. The results obtained from dynamometer car tests of these engines follow:

Tractive Effort	Consolidation Saturated	Mikado Superheated
At start	45,500 lb.	47,000 lb.
5 miles per hour	43,000 lb.	46,500 lb.
10 miles per hour	38,500 lb.	41,500 lb.
15 miles per hour	29,500 lb.	34,000 lb.
20 miles per hour	22,500 lb.	27,500 lb.
25 miles per hour	17,500 lb.	23,000 lb.
30 miles per hour	13,000 lb.	18,500 lb.
35 miles per hour	9,000 lb.	16,000 lb.

The reason for converting these engines from Consolidation to Mikado was due mainly to the fact that the old Consolidation engines had a comparatively small boiler capacity. The operating conditions on a single-track railroad like the Big Four demanded an engine with high, sustained draw-bar horse-power capacity at high speeds from 25 to 45 m.p.h. The horse-power capacity on the old Consolidation engines reached maximum at about 20 m.p.h. and decreased very rapidly above this speed. For this reason they proved to be very unprofitable and unsuitable from an operating standpoint.

ERIE RAILROAD

By Wm. Schlafge, General Mechanical Superintendent.

During the past four years this company has redesigned four classes of locomotives, the modifications consisting of the application of superheaters, piston valve cylinders, brick arches and outside valve gears. Regarding the results ob-

tained from this practice: Comparative tests of the rebuilt locomotives against those of the saturated-steam locomotives indicate savings of 25 per cent in fuel and 33 per cent in water. Coal stops are eliminated and water stops reduced. The 2-8-0 superheater locomotives will haul from 250 to 400 tons more, over a 140-mile division, in from two to three hours less time than the saturated-steam locomotives. We also find that the brick arches assist in the elimination of black smoke, and less trouble is experienced in maintaining fire boxes. Tests indicate that the brick arches alone effect a saving of about 8 per cent in fuel.

GREAT NORTHERN

By R. D. Hawkins, Superintendent Motive Power.

One reason for modernizing equipment comes from the fact that later new power superheated and of larger capacity on one division unbalances the assignment of power on adjoining divisions, making it necessary to set out or pick up additional cars at terminals. To illustrate conditions with this company: In 1905 we purchased a large number of Prairie type engines having a tractive power of 37,500 lb. Since that time we have purchased 70 Mikado engines having a tractive power of 60,000 lb. The Mikados are assigned to a division with ruling grade of .8 per cent, and the Prairie engines run over a connecting division with a ruling grade of .4 per cent, and will not bring in as much of a train as the Mikados will take out of the terminal. By superheating the Prairies we have brought about the desired result. When we again purchase power for the .8 per cent grade line, we expect to provide Mallet engines with a tractive power of 100,000 lb., and use the Mikados on the lower grade line, and the Prairie type engines will be crowded out, unless we are able to modernize them further. To do this we propose to take two of the Prairie type engines, combining them, making a tank Mallet type.

NEW YORK CENTRAL LINES

In an interview with Mr. H. L. Ingersoll, Assistant to President, New York Central Lines, he emphasizes the following:

In order to make conversion of existing power profitable, it is necessary first to make a thorough study of the type of engine best suited for the service. Investigate carefully so as to find out what is the best possible locomotive for the service, considering the matter of wheel loads, weight of rail, grades, curvature, speed, etc. Consider what improvements can be made in appliances which the existing engines do not possess, such as superheaters, outside valve gear, outside steam pipes, etc. See how much of the old locomotives can be used, such as tender, tender truck, driving wheels, driving boxes, fittings, trucks, truck wheels and similar parts. The cost of a new engine fully up to date and efficient in all respects should be ascertained, and then an estimate of the cost of converting the existing engines into efficient power should be made or obtained. As a general propostion it will not pay to spend over 50 to 55 per cent of the cost of new engines. Do not convert an engine unless it can be made into a thoroughly efficient engine, which will be entirely suitable for the service and equipped with all modern economical appliances.

NORFOLK & WESTERN

By W. H. Lewis, Superintendent Motive Power.

Our conception of modern railroading rather conveys something more than has been accomplished or greater than heretofore constructed. Applying such a view to the modern engine, the increasing of the capacity of existing units would seem to be very limited, as the wheel load is the first apparently inflexible quantity. This would seem to be true, except what has been accomplished by the application of the superheater and possibly with another exception, the addition of the automatic stoker. Both the superheater and stoker add capacity, though the latter really permits higher average work to be accomplished.

CONCLUSIONS

The tremendous increase in weight, size and power has come in the first fifteen or sixteen years of this century. In many instances this increase in size of locomotives was in advance of the bridges and roadway, so that it was necessary to rebulid a large portion of the main lines in this country. Now that this has been accomplished and the roadbeds laid with heavy rails and provided with bridges of sufficient capacity to carry the heaviest wheel loads, it is a question whether the increase in weight and power of locomotives can take place as rapidly in the next ten or fifteen years as in the opening years of this century. Assuming this is the case, and that there will be no such tremendous increase in the power of locomotives for the next few years, it logically follows, then, than their life may be increased by renewals of parts. Therefore, instead of taking twenty as an approximation of the number of years an engine would last in service, the life of the large modern locomotive may be increased for a longer period. During this time it would be necessary to renew many parts, and it is also probable that many economical devices which would fall under the head of modernizing of existing locomotives could also be applied. It is therefore quite possible that a greater proportion of locomotives will be rebuilt or modernized in the future than in the past.

DISCUSSION

C. D. Young, (Penna.): The Committee makes a statement, following the quotation from Penna. R. R. Bulletin 23, that due to the long cutoff, it would appear that some decrease in economy would result. That would be the case if you did not have a Walschaert valve gear of standard design on the locomotive, but with the Walschaert valve gear as commonly used in American practice, the changing water rate between 23 or 25 per cent, and up to 40 per cent is very slight. The water rate increases at lower cutoff and also increases at points above, although the line is very flat when using superheated steam. I would point to the necessity of exercising caution in taking that statement as indicating you could not successfully use a smaller valve than is commonly accepted as good practice. As a matter of fact, in using highly superheated steam, the water rate is very uniform throughout the full range of cutoffs, only increasing sharply at the very long cutoff or short cutoff, and therefore the length of the cutoff has no control of the water rate between certain restrictive limits, which limits cover the points of cutoff largely used by the engineer on the road.

It may be of interest for you to know that we have tested a locomotive on the plant with a 12-in. valve, and have obtained as low a water rate as we have obtained on any other engine, 3,300 indicated horse power. I think that is substantial evidence that for even large size cylinders the 12-in. valve can be used. The principal feature developed in this report points to the fact that we can use one size of valve for all locomotives, which, of course, you will appreciate is a great advantage when it comes to maintaining these locomotives, and that the use of the 14-in. valve or 16-in. valve is hardly justified in view of any slight gain you might be able to make due to maintaining that larger and heavier valve.

J. Snowden Bell: Replying to Mr. Young, I would say that the Committee had not lost sight of the importance of standardization, and its advantage along the lines of carrying as few sizes as possible, nor did they positively say that the smaller valve as recommended by the Pennsylvania was not desirable or proper, but in view of the very considerable difference between diameters recommended in the Pennsylvania tests and those of the manufacturers as shown by our table on the preceding page, we said that statements should be accepted with caution, leaving it to the judgment of the constructor as to how far he would feel warranted in following it.

Train Resistance and Tonnage Rating

The committee has considered the frictional resistance of the six-wheel truck gondola cars of the Norfolk & Western as compared with the resistance of four-wheel truck cars of 50 tons capacity. It has gone more thoroughly into the discussion of tractive effort of locomotives at various speeds, both with saturated and superheated steam, comparing the different recognized methods with actual dynamometer car tests. References are given to the sources from which complete descriptions of the various methods may be obtained if desired. The draw-bar-pull method of tonnage rating was recommended in the 1914 report of the committee but was criticized on account of its complication as compared with the adjusted tonnage method.

O. C. Wright, Chairman

A careful study has been made of these methods of computing tonnage ratings, it being shown where either may be used to the best advantage.

O. C. Wright, assistant engineer of motive power of the Pennsylvania Lines West, is chairman of the committee. The other members are: W. E. Dunham, supervisor motive power and machinery, Chicago & North Western; H. C. Manchester, superintendent motive power, Delaware, Lackawanna & Western; C. E. Chambers, superintendent motive power, Central of New Jersey; J. H. Manning, superintendent motive power, Delaware & Hudson; Frank Zeleny, engineer of tests, Chicago, Burlington & Quincy, and Prof. E. C. Schmidt, University of Illinois.

At the 1914 convention this committee submitted a report containing as complete data on this subject as were available at time, with various recommendations. Since this time the committee has collected some further data on this subject and has also given careful consideration to the points brought out in the discussion at the 1914 convention.

Train Resistance

Frictional Resistance.—Tests have been conducted on the Pennsylvania Railroad with higher capacity cars than any of those for which resistances were given in the committee's previous report. Tests were made with Norfolk and Western Class Gka 90-ton, 6-wheel truck gondola cars, which indicate a resistance in pounds per ton approximately 40 per cent in excess of similar figures for cars with 4-wheel trucks having a capacity of 50 tons. A resistance curve as plotted from the data obtained in these tests is shown in Fig. 1. This curve was obtained by measuring the resistance per car of a train made up of this class of cars, first, with cars having a total weight of 30 tons, and second, with cars having a total weight of 121 tons, and assuming that the resistance per car for intermediate weights would fall on a straight line joining two points plotted from the data obtained. A curve obtained in the same manner for Pennsylvania Class H21a cars is also shown in Fig. 1. In these tests the point *P*, Fig. 1, was determined experimentally, and it will be noted that this point does not fall exactly on the curve. The Class H21a cars above referred to have a capacity of 70 tons, a light weight of 25 tons and are provided with 4-wheel trucks and 6½ in. by 11 in. journals. Full information in regard to these tests is contained in Pennsylvania Railroad Test Bulletin No. 26.

Curve Resistance.—Some additional data on curve resistance have been collected by the Pennsylvania Railroad and published in Test Plant Bulletin No. 26, as shown in the tabulation below:

Resistance, Pounds per ton per degree, Level Curve

Train Passing Completely Over Curve

Curvature.	Maximum. Resistance,	Minimum. Pounds per ton,	Average. per degree.
2 deg.	1.54	0.76	1.01
1 deg.	0.98	0.20	0.51
1 deg.	1.63	0.47	0.89
Average			0.80

Train on Curve Only

Curvature.	Maximum. Resistance,	Minimum. Pounds per ton,	Average. per degree.
2 deg.	1.16	0.12	0.58
1 deg.	1.22	0.42	0.74
1 deg.	1.74	0.69	1.13
15 min.	1.32	0.08	0.87
Average			0.83

These figures confirm the previous recommendations of the committee that an average figure of from 0.8 to 0.9 lb. per ton per degree of curve be used for curve resistance. The committee considers the larger value to be more applicable for general conditions and more conservative for the purposes of tonnage rating.

Tractive Effort

In 1914 the subject of the tractive effort of locomotives was too briefly discussed, and the committee wishes to supplement the previous report in this connection.

Differences in the quality of the fuel, in the grate area, in the fireman's skill and endurance, in the condition of the locomotive, in the ratio of heating surface to cylinder volume, and even in weather conditions, all result in differences in the obtainable tractive effort at speeds above 5 m. p. h.; and success in calculating tractive effort depends largely upon the skill and judgment with which these factors are evaluated.

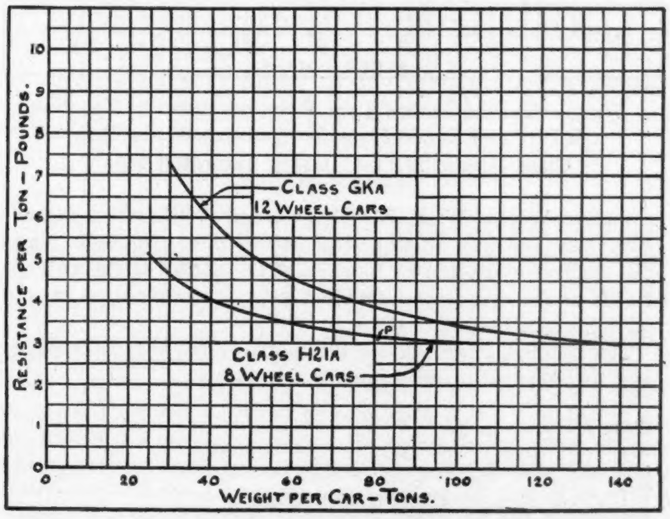


Fig. 1.—Resistance of Norfolk and Western Class GKa Cars and Pennsylvania Railroad H21a Cars

Many methods have been proposed, and some of them give results which agree fairly well with the results obtained by tests; and an understanding of the assumptions which underlie them and discrimination in the choice of the method will frequently enable one to calculate tractive effort with a degree of accuracy sufficient for the purposes of tonnage rating.

To aid in such a choice the committee presents for each of two characteristic freight locomotives a series of curves showing the tractive effort at various speeds. One of the curves is

derived from dynamometer car tests and the other four curves are derived by one or the other of the four most acceptable methods of calculating tractive effort.

Saturated Steam Locomotives.—Five curves showing the relation between tractive effort and speed for Pennsylvania Railroad locomotives of the H8b Class are shown in Fig. 2. The heavy line represents the tractive effort determined by dynamometer car tests, and the four other curves have been calculated according to methods proposed by the Baldwin Locomotive Works, W. F. Kiesel, Jr., A. S. Williamson and the American Railway Engineering Association. On both plates the tractive effort shown by each of the curves is the pull obtained at the rear tender drawbar when the locomotive runs at uniform speed on level track.

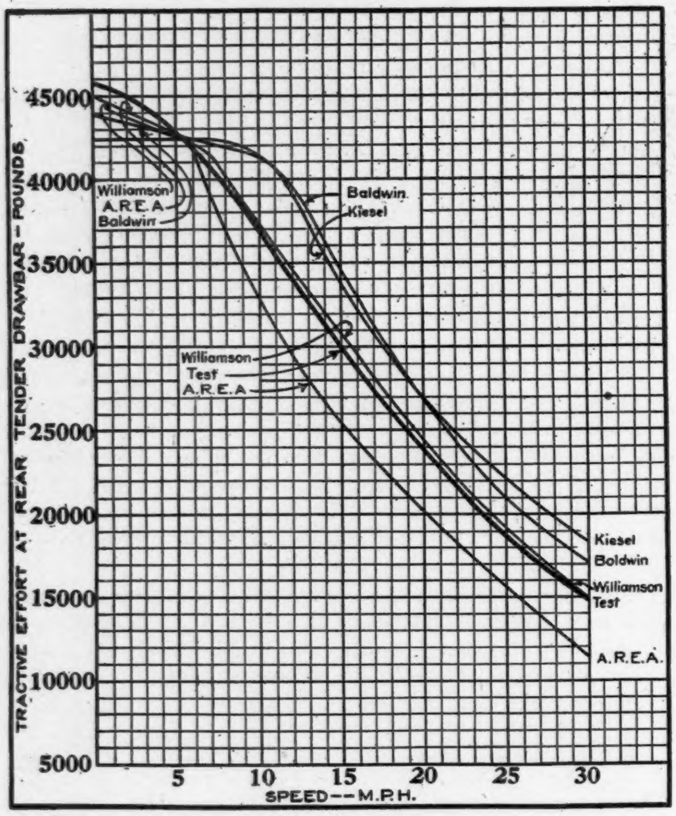


Fig. 2.—Curves Showing the Relation Between Tractive Effort and Speed for a Locomotive of the H8b Class (Consolidation) Using Saturated Steam

The H8b is a Consolidation locomotive using saturated steam, and its principal dimensions are as follows:

Class	H8b
Type	2-8-0
Size of Cylinders, in	24 by 28
Type of Valve	14-in. Piston
Diameter of Driving Wheels, in	62
Steam pressure, lb. per sq. in	205
Size of Firebox, in	72 by 110
Grate Area	55.13
Heating Surface, Firebox	187
Heating Surface, Tubes (water side), sq. ft	3,652
Heating Surface, Total (water side), sq. ft	3,839
Heating Surface, Total (fire side), sq. ft	3,395
Weight on Truck in working order, lb	27,300
Weight on Drivers in working order, lb	211,000
Total wt. of Locomotive in working order, lb	238,300
Weight of Tender, lb	158,000
Number of Wheels under Tender	8

The curves showing the dynamometer tests are derived from numerous road tests made with trains in regular service. Among the numerous values thus determined there is, of course, considerable divergence. The curves were drawn to represent neither the highest of these values nor the general average, but they were made to represent approximately the mean between these two.

The Baldwin Locomotive Works Method is described in the 1914 edition of "Locomotive Data," published by the Baldwin Locomotive Works. The starting effort at the driver rims is first calculated by the usual formula. The tractive effort at various speeds is next determined by multiplying this starting effort by factors derived from one of the series of curves. Seven such curves are presented for different ratios of rated tractive effort to heating surface.

The Kiesel Method is presented in detail in "Locomotive Operation and Train Control," by A. J. Wood, published by the McGraw-Hill Book Company in 1915. The process involves the use of formulae for cylinder tractive effort, for machine friction, and for the resistance of the locomotive and tender. Mr. Williamson's method is fully explained in the *Railway Age Gazette* of March 22, 1912, vol. 52, No. 12, pp. 685-689. It takes into consideration the heating surface, the evaporation, the variable steam consumption per horse-power at different speeds, the quality of the fuel, and the various resistances.

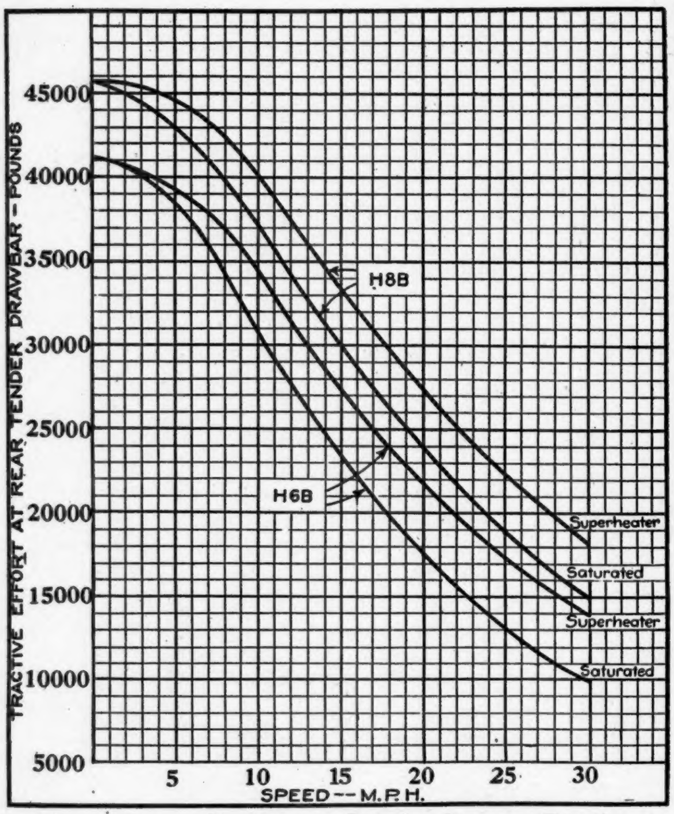


Fig. 3.—Curves Showing the Relation Between Tractive Effort and Speed for Two Superheater Locomotives of the H6sb and H8sb Classes, and for Two Locomotives of the Corresponding Classes Using Saturated Steam

The American Railway Engineering Association Method was presented originally by the Committee on the Economics of Railway Location of the American Railway Engineering Association in its report in 1911, and was modified to make it applicable to superheater locomotives in that committee's report in 1915. Both reports are published in the Proceedings of the Association for these years, and their substance is combined and published in the 1915 Manual of the Association on pages 526-534. This process is based on assumptions concerning coal consumption, evaporation per pound of coal of different grades, and the steam consumed per indicated horse-power at various speeds. Its fundamental assumption of an hourly coal consumption of 4000 lb., while suitable for the purposes for which the method was devised, makes it rather too conservative for the purpose of tonnage rating.

It can not be too strongly emphasized that in the choice of a method the original explanations above referred to should be carefully considered to determine whether their fundamental assumptions are applicable to the case in hand.

Superheater Locomotives.—The Baldwin, the American Railway Engineering Association, and the Kiesel methods, above referred to, all include modifications by means of which tractive effort at various speeds may be calculated for locomotives using superheated steam, as well as for those using saturated steam. In order, however, to provide some standard by which the correctness of these methods may be judged, the committee presents in Fig. 3 actual test curves derived from locomotives using superheated steam.

These curves are derived by means of dynamometer car tests and they give values of drawbar pull available at the rear tender drawbar when the locomotive runs on level track at uniform speed. The lower curve of each pair relates to Pennsylvania locomotives of the H6b or the H8b Classes, both of which use saturated steam, and the principal dimensions of

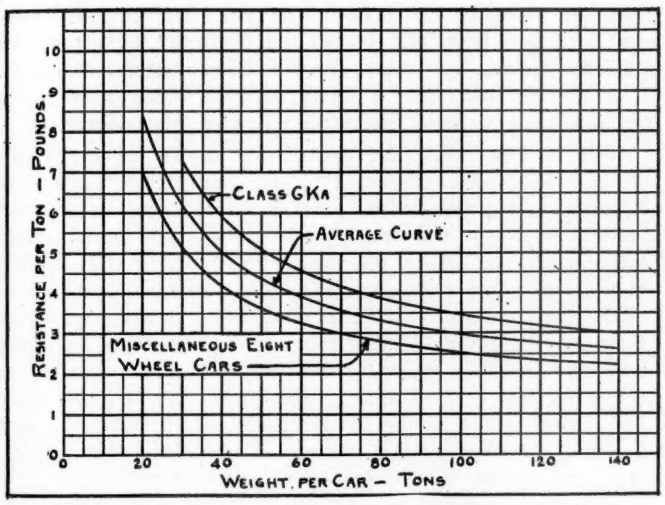


Fig. 4.—Comparision of Resistance Curves of Norfolk and Western Twelve-Wheel Cars (Class GKa) and Miscellaneous Eight-Wheel Cars

the H8b being presented above. The upper curve of each pair in Fig. 3 relates to the corresponding class of superheater locomotives. The main respects in which these locomotives differ from the H6b and H8b Classes are indicated in the following table. Their other dimensions are identical with those given in the preceding table.

Class.	H6sb.	H8sb.
Heating Surface, Firebox	166.5	187
Heating Surface, Tubes (water side), sq. ft....	2,105.3	2,841.2
Heating Surface, Superheater (fire side), sq. ft.	537.7	782.2
Heating Surface, Total Equivalent	3,078.3	4,201.5
Weight on Truck, in working order, lb..........	23,900	29,600
Weight on Drivers, in working order, lb........	160,900	219,900
Total Weight of Locomotive, in working order, lb.	204,800	249,500
Weight of Tender, Loaded, lb..................	143,000	158,000

It is fair to assume that the ratios between the tractive effort for the superheater locomotive and the tractive effort for the saturated steam locomotive are not greatly different from the ratios which would be obtained with any corresponding locomotives of similar design.

Consideration of Discussion of the 1914 Report

It is felt advisable to take up each of the points brought out in the discussion of the 1914 report separately, as follows:

1. The question of curve resistance was brought up and it was suggested that the curve resistance allowance should not be based entirely on the weight of the train. The committee has been unable to find any better factor upon which to base curve resistance. It should be borne in mind, however, that in considering curve resistance, and in the application of the recommended figures, the length of the curve must be taken into consideration and the total resistance calculated for only that part of the train which is actually on the curve.

2. The recommendation of the committee in regard to the adoption of the drawbar pull method of determining tonnage rating was criticised on account of its complication as compared with the adjusted tonnage method. The committee has given this matter very careful consideration and feels that while the adjusted tonnage method is sufficiently accurate under certain conditions, there is opportunity for error in the use of this method under certain other conditions. The adjusted tonnage method of computing tonnage rating is based on the assumption that the resistance per car varies directly with the weight of the car. In other words, it is necessary to know the resistance of the cars in question under two conditions of loading only in order to plot a car resistance curve. From this curve a curve showing the relation between resistance per ton and weight per car can be plotted. However, the use of such resistance curve is entirely unnecessary with this method of computing tonnage rating, provided the two resistances determined by test represent the average light car and the average heavy car in service on the division for which the rating is desired.

With the drawbar pull method it is necessary to know the resistance per ton for each weight of car under consideration, which must be determined by test or obtained from a curve drawn as the result of tests. Whether or not the adjusted tonnage method will give the same results as the drawbar pull method will depend on how closely the resistance per ton curve used agrees with the curve constructed by the method which was used for Fig. 1.

While the adjusted tonnage method gives a close approximation for conditions where the cars under consideration are of practically the same type of construction, appreciable errors are likely to be introduced in applying this method to divisions where the cars vary widely in type and capacity. For example, on a division using the two types of cars for which resistance curves are shown on Fig. 4, it would not be practicable to adopt a car allowance factor which would be suitable for two trains, one made up of one type of car and the other of the second type, neither would it be desirable to adopt a car allowance factor based on the average of the two.

Recommendations

Based on the 1914 report and the foregoing supplementary report, the committee desires to present the following recommendations in connection with the determining of train resistance and the computing of tonnage ratings.

Train Resistance.—Where possible, frictional resistance should be determined by actual tests with a dynamometer car; where a dynamometer car is not available, this resistance may be taken from the curves shown in Figs. 1 and 3 of the 1914 report and Fig. 1 of this report. In using these curves, those which seem to best suit the conditions under consideration should be selected and trials made before final adoption.

Grade resistance should be taken as 20 lb. per ton per 1 per cent of grade, and the length of the grade, in comparison with the length of the train, should be taken into consideration.

Curve resistance should be calculated at from 0.8 to 0.9 lb. per ton of train on the curve per degree of curvature.

Tonnage Rating.—In setting a tonnage rating for a division, the tractive effort of the locomotives in question should first be determined, either by actual test using a dynamometer car, or where a dynamometer car is not available, by calculations based on any one of the methods outlined in the foregoing report, the results of which are covered in Figs. 2 and 3. Having determined the tractive effort available on straight and level track as above, deductions should be made for grade and curvature resistance of the locomotive, the grade resistance being taken as 20 lb. per ton per one per cent grade and the curve

resistance as 1½ lb. per ton of locomotive and tender per degree of curve.

On divisions where the car equipment is of practically uniform design and where the cars are of practically uniform capacity, the adjusted tonnage method may be used with a reasonable degree of accuracy, and the calculations should be made in accordance with the method outlined in the 1914 report. On divisions where there is a wide variation in the type and capacity of cars, a careful study of the situation should be made before the adjusted tonnage method is adopted, and if this method is found to introduce appreciable inaccuracies as illustrated in the foregoing report, the drawbar pull method should be used.

Tonnage ratings should be graduated to suit the variations in weather conditions and calculations for the necessary reductions in rating may be made as covered in section 4-D of the 1914 report.

The tonnage ratings should be tabulated in any form convenient for the use of the transportation department. The forms as shown in Tables 1 and 3 of the 1914 report are recommended. The former is applicable to ratings calculated by the adjusted tonnage method and the latter to ratings calculated by the drawbar pull method.

DISCUSSION

O. C. Wright (Chairman): In connection with the recommendations under the head "Frictional Resistance," in first reading this it might seem like a pretty weak-kneed recommendation, but in view of the fact that there are so many variables that enter into train resistance, the committee felt that was about as close as they could come to a definite recommendation. In addition to the recommendations as covered in the report, the committee, realizing that there is a considable amount of data which will be available within the next year or so, particularly with reference to the resistance of modern cars, would like to recommend that this subject be continued by the Association, either with this or some other committee. I make that as a motion.

C. D. Young (Penn.): In continuing this committee, if the motion prevails, I would like to call attention to where the committee suggests that the matter of tonnage ratings for different divisions, although of importance, cannot be covered by them. I think it should be covered by them. Now we have some formulas, for working out the drawbarpull at full speed of the locomotives, and as we have some data on the resistance of vehicles, I think the next thing to do is to make sure that the ratings are set properly, and after they are set properly, that we load the trains according to the ratings. If there is any one thing which will decrease the pounds of coal per ton mile it will be to get proper tonnage behind the locomotive, and incidentally it will save a good deal of money in other ways for the railroad.

Mr. Wright: In considering that point the committee did not feel they could make any definite recommendation on account of the variation in organization of the different railroads. It seemed almost impossible to us at least, at the time we considered it, to arrive at anything which would be of any benefit at all. The committee, however, will be glad to consider the matter further.

Prof. L. E. Endsley, (Univ. of Pitts.): I notice in Fig. 1, some very interesting differences between the eight and twelve-wheel cars. For instance, I figured out that the weight of the 12-wheel car was 5 tons per axle, light, and the others about 6¼, and yet we have 50 per cent greater friction on the 12-wheel car. I do not know why that should occur. It enters into my mind that there may have been some difference in the brakes dragging or trouble with the lubrication or something else that would cause that difference. I am wondering if the committee found the same difference in passenger cars. I note when they get down to the loaded cars they are right together. If it was a difference in the temperature of the journals or in the brakes dragging, that would disappear down there. The small journal on the six-wheel cars would indicate less friction for the light load, and yet it shows much more.

Mr. Wright: The committee went over the information given us by the testing department of the Pennsylvania very carefully in connection with the resistance of those cars, and so far as we were able to determine the tests were accurately made, and there was nothing which entered into the data which would in any way affect the readings.

Angus Sinclair: Many years ago the Baldwin Locomotives Works delivered a group of locomotives to the Burlington, Cedar Rapids & Northern Railway, and after they had been in service for some time complaints were made that the engines did not come up to the guarantee. The locomotive company discussed the matter with the road for some time and then they made the request that I go and make tests for the locomotives for their traction and steaming capacity. I went there and made a series of tests which were really the first tests on train resistance made in this country.

Until a few years ago what was known as the Clark formula was universally used in calculating train resistance. Kinnear Clark, the author of that formula, was a Scottish railway engineer, who made many experiments with British locomotives and trains, the results having been made public in his well-known book on railway machinery published about 1855. According to Clark's formula there is a resistance to train movements of 8 lb. per ton, and the resistance increases with the speed at the rate of the square of the velocity in miles per hour divided by 171. American engineers had modified this to read 6 lb. per ton for the constant resistance, and accepted the remainder of the rule, so that the common practice has become to calculate the resistance to trains on a straight level track to be

$$\frac{V^2}{171} + 6 = R$$

By the courtesy of the New York Central management I was permitted in 1892 to make a series of tests of the locomotive pulling the Empire State Express. In one of the runs a speed of 70 miles an hour was maintained for several miles and indicator diagrams were taken when the engine was doing the work of maintaining the speed without loss or gain. The power developed showed that the entire resistance of the train and the locomotive at that speed was 17.6 lb. per ton. According to the Clark formula, so frequently used, the resistance per ton at 70 miles an hour is over 34 lb. If this were true, there is not a locomotive in the country that could keep a train of 300 tons moving at a speed of 70 miles an hour. This rule is utterly worthless and has no right to be used to deceive people who are striving to find an accurate basis to calculate from.

On the Chicago, Burlington & Quincy a great many records were made, years ago, to find out the resistance of different kinds of freight trains, with a view to finding out how many cars certain locomotives ought to haul. A train of loaded freight cars weighing 940 tons gave an average resistance of 5½ lb. per ton when running 20 miles an hour on the level. A train of empty freight cars weighing 340 tons showed a resistance of 12 lb. per ton while running 20 miles an hour on level track. A passenger train weighing 363 tons gave 7½ lb. per ton resistance at a speed of 30 miles an hour. The records respecting train resistances of the roads operating dynamometer cars agree substantially with the resistance of the Empire State Express.

(The committee was continued.)

Report of Committee on Subjects

THE committee suggests for the consideration of the Executive Committee, in preparing the program for the 1917 convention, the following twelve subjects for investigation by committees; also one subject for an individual paper. Three subjects are also suggested for topical discussion.

1. STOKERS.—Continue the committee. One or two of the newer types of stokers have not yet been tried out on a decisive scale.

2. STANDARDS, REVISION OF.—Continue the committee. The committee should consider how far the material specifications of other societies, such as the American Society for Testing Materials, can be adopted by the Master Mechanics' Association.

3. FUEL ECONOMIES.—Continue this subject, with a view of showing as far as possible aggregated economies effected by the newer types as well as improvements already made in existing types of locomotives; also to report whether improvement in draft appliances have kept pace with other improvements. The idea of this question is to show the net results in performance effected by the improvements in the past few years.

4. SPRINGS—SHOP MANUFACTURE AND REPAIR, INCLUDING DESIGN, APPLIANCES AND REPAIR.—It is beyond question that the springwork of our shops has been very crude. There is, or has been, much room for improvement, not only in design, but in shopwork of shaping, cambering, heating, hardening, drawing and assembling.

5. DRAW BARS AND AUXILIARY COUPLINGS BETWEEN ENGINES AND TENDER.—Best practice.

6. SUPERHEATERS.—What is the most effective degree of superheat? What is gained by superheat in the exhaust steam? Would a steam and water separator below the throttle effect sufficient saving to justify its application? The first questions need no explanation. The last deals with the question of intercepting the "slugs" of water which are from time to time carried into the superheater and cylinders.

7. ADVANTAGES OF SOLID BUSHINGS FOR SIDE RODS AND FRONT END OF MAIN RODS.

8. PRINTED LOCOMOTIVE MAINTENANCE INSTRUCTIONS AND SCHEDULES —It is believed that on roads with several shops, uniformity can only be effected by detailed instructions, preferably printed.

9. HEATING OF TRAINS DRAWN BY ELECTRIC LOCOMOTIVES.—A committee to consider flash and other boilers and recommended capacities. This question becomes a serious one when steam-heated trains are to be hauled for any long distances by electric locomotives. The question of the size and type of boiler, method of heating (that is, electricity or fuel) should be considered. Capacity suitable for steel steam trains should be provided.

10. MOTOR DRIVE OF ELECTRIC LOCOMOTIVES, NAMELY, GEARED MOTORS, GEARLESS MOTION, JACK-SHAFT DRIVES, BOTH GEARED AND GEARLESS, RESULTS OBTAINED AND SERVICE FOR WHICH EACH IS MOST SUITABLE.

This question is still in course of development, but it is believed that sufficient progress has been made to justify a report.

11. LIMITATIONS OF MALLET LOCOMOTIVES. PRESENT STATUS IN ROAD SERVICE.

12. POWDERED FUEL.—Continue this subject. Report progress up to date.

INDIVIDUAL PAPER

13. FEED-WATER HEATERS.—Review the subject up to date.

TOPICAL DISCUSSIONS

14. BEST MAINTENANCE OF METALLIC PACKINGS FOR SUPERHEATER ENGINES.

15. INSTRUCTIONS TO YOUNG FIREMEN: NUMBER OF MEN TO EACH INSTRUCTOR.—Recommended status of each instructor.

16. BEST METHOD OF INTRODUCING OIL TO CYLINDERS OF SUPERHEATER LOCOMOTIVES.

The report is signed by A. W. Gibbs, chairman, chief mechanical engineer, Pennsylvania Railroad; D. R. MacBain, superintendent motive power, New York Central Lines West; and C. E. Fuller, superintendent motive power and machinery, Union Pacific.

OTHER BUSINESS

The report of the Committee on the Best Designs and Materials for Pistons, Valves, Rings and Bushings, which was presented on Tuesday, was to have been discussed Wednesday morning, but no discussion took place, owing to the absence of the chairman of the committee.

The topical discussion scheduled on the program was omitted because of lack of time.

Mr. Pratt: F. W. Thomas, the supervisor of apprentices of the Atchison, Topeka & Santa Re, was invited by the Executive Committee to read a paper on Apprenticeship Schools.

(An abstract of Mr. Thomas' paper will be found elsewhere in this issue.)

F. W. Thomas: It was the intention of the officers of the National Association of Corporation Schools that the association should be represented here by George M. Basford. He is known as a man interested in this work, but it was afterwards thought that it would be best for someone engaged in actual railroad work to present the case of that association before you.

Mr. Pratt: We would like to hear from the father or the grandfather of the apprenticeship system, in this association.

G. M. Basford: The honor of the mention of my name in this connection is very greatly appreciated. Eleven years ago today I pleaded with you to train your young men. Today I warn you to do it. The motive power department of the future will be what you make it by the training of men. If you train them, the department will be what it ought to be. If you do not, it will ultimately be dominated by men who do not understand it. Then the life of the mechanical department officer will not be happy or successful. Which will you choose? For your own selfish interest, which? For the interests of your employers, which? I warn you to do these simple things quickly: Select your recruits carefully; train them thoroughly; educate them or see that they are educated; provide broader education for a selected few; promote them intelligently, fairly and systematically, and insist that every gang leader, sub-foreman, foreman and official train and prepare his own successor. You will leave a sad legacy if you neglect or further defer this.

ELECTION OF OFFICERS

The following officers were elected for the ensuing year: President, Wm. Schlafge, Erie Railroad; first vice-president, F. H. Clark, Baltimore & Ohio; second vice-president, W. J. Tollerton, Chicago, Rock Island & Pacific; third vice-president, C. F. Giles, Louisville & Nashville; treasurer, Dr. Angus Sinclair.

The following were elected members of the executive committee: John Purcell, Atchison Topeka & Santa Fe; M. K. Barnum, Baltimore & Ohio, and W. E. Dunham, Chicago & North Western. M. A. Kinney, Hocking Valley, was elected to serve on the executive committee during the unexpired term of J. F. De Voy.

James W. Dow was elected a life member of the association.

During the closing ceremonies of the convention, the past president's badge was presented to the retiring president by Scott Blewett.

Mr. President and gentlemen: As I look back on my years, rolling, rolling away, when I was first allowed to be with the gentlemen of this convention, they look far off, and yet they are very close, because the happiest memories of my life are connected with those days.

That your associates feel that you have been worthy of leadership, they desire to place this badge upon you that it may testify that they have felt you, to in every sense of the word, be a worthy man to be their leader. Your associates have felt that you have not neglected to say any kind word, that you have not neglected to do any good deed that you might do, bearing in mind the thought that you might not pass this way again.

The convention adjourned.

COST OF SMALL SHOP TOOLS

By J. J. Sheehan

President American Railway Tool Foreman's Association

[This is one of the articles included in the report of the Committee on Co-operation with Other Mechanical Organizations, which appeared in the *Daily* of June 21, 1916, page 1493.]

We wish to recommend the following methods for arriving

Form Standard The A.B.C. Ry.

(Insert Name of Railway Company)

STORE DEPARTMENT—STOCK C

S. O. 500 3 - 3 - 1916

Reqn. S. D. No.

To MECHANICAL DEPARTMENT

Please make the following

Standard taper Reamers

24 - 1" x 16"

24 - 1 1/32" x 16"

24 - 1 3/32" x 16"

As per drawing # 123-2

Form 1

at the cost of small shop tools as made in a central shop on a large railroad system.

In order that this may be made clear, we are making a selection of one standard shop order, which order will be known as No. 500. This order for 24 reamers, each 1 in., 1 1/32 in., 1 3/32 in., 16 in. long, originates in the store department. Same will be made out on a standard form, known as Form 1. Form 1 shows complete details of the work to be done on the shop order, this form being passed to the office of superintendent of shops by the store department, and from that department the order on this form is sent out to the general toolroom to have the reamers made up complete.

As soon as the toolroom foreman receives notice of the shop order, he immediately makes out his requisitions on Form 2,

Form 2 Standard

A. B. C.-Ry. Co.

S. O. No. 500 3/3/16 M. D. Nº 130602

Storekeeper 3 - 4 - 16

PLEASE DELIVER TO BEARER.

QUANTITY	ARTICLE	WRITE NOTHING IN THESE COLUMNS: QUANTITY	PRICE	AMOUNT
72	Pcs. 1¼" Rd. Cres. "C" Steel			
	Annealed			
	Each 16" long			

Charge Account

Engine

Symbol "John Doe" Foreman

Form 2

covering the number of feet and the diameter of the steel to be used in making the reamers as called for.

The material is then delivered from the store department

Symbol Letter Form 3 Standard

Eng. The ABC Ry

S. O. 500

Car (Insert Name of Railway Company)

Acct. No. Department No. Month March - 1916

Name	No	Date	7	11										Total Time	Rate	Amount
——	434		–	—												

Shop Timekeeper Prorated by

Form 3.—Front Side

to the tool manufacturing department, and the tools placed in line for manufacture.

The number of hours and the amount of labor on each operation performed is shown on Forms 3 and 4. These forms are

Eng. Car S. O. 500 Acct. Symbol Letter

Date	Man No.	Detail Description of Operation	Schedule Number	Pcs.	Total Hours
	434	Stamp 72 Std Taper Reamers			
		24 1" Dia. A. & D. 1"-¼" Taper in 12"			
		24 1 1/32" " " 1 1/32 " " " "			
		24 1 3/32" " " 1 3/32 " " " "			
		1654 Letters		1654	– —

Reverse Side of Form 3

Continued Operations Marked X

To Work Record Charge No.

From " " " John Doe Foreman

Form 3.—Reverse Side

used by the timekeepers to keep the exact amount of time spent on the shop order by each individual workman.

When the tools are completed by the shop and ready to be turned over to the store department, the toolroom foreman

SYMBOL LETTER Form 3 Standard

The ABC Ry. 1

ENG. ____
S. O. 500
CAR ____
ACCT. NO. ____

DEPARTMENT NO 2-6 MONTH March-1916

NAME	NO.	DATE 6	7	8	9	10	11						TOTAL TIME	RATE	AMOUNT
	458	-	-	-	-	-	-						-	-	-

HOURS

"John Doe" SHOP TIMEKEEPER ____ PRORATED BY

Form 3.—Front Side

ENG. ____ CAR ____ S. O. 500 ACCT. ____ SYMBOL LETTER ____

DATE	MAN NO.	DETAIL DESCRIPTION OF OPERATION	SCHEDULE NUMBER	PCS.	TOTAL HOURS
	458	Cut, Center & turn 72 standard Taper Reamers 1/16" Taper in 12"			
		24 - 1" dia. x 16" Long = 384"	TZR4-16-a	384	
		24 - 1 1/32 " x 16" } 768"	TZR4-16-B	768	
		24 - 1 3/32 " x 16"			

CONTINUED OPERATIONS MARKED X TO WORK RECORD CHARGE NO. ____ FROM " " " "

"John Doe" FOREMAN

Form 3.—Reverse Side

Date 3-5-16 Form 4 Standard FOREMAN'S WORK ORDER No ____

SO Charge { 500 Man No { 458

Operation	SCH. NUMBER	NO. PCS.	TOTAL TIME
Cut Center & turn seventy two Reamers 1/16 taper in 12"			
24 - 1" Dia x 16" long = 384"		384	
24 - 1 1/32 " x 16" } 768"			
24 - 1 3/32 " x 16"		768	

SHOP TIMEKEEPER ____ FOREMAN "John Doe"

Form 4.—Front Side

MAN No	DATE 6	7	8	9	10	11						TIME
458	-	-	-	-	-	-						

Prorated by ____

Form 4.—Reverse Side

makes out a completion report, Form 6, showing the requisition numbers covering the material which was used in completing the shop order. If there are any comments to be made

(Form 5 Standard)

A.B.C. Ry.

Insert Name of Railway Company

3/31-1916

STOREKEEPER:

The following material on your order No. 500-3/3 finished and ready for shipment: Stock

NUMBER	DESCRIPTION OF ARTICLE
24	1" x 16" long Std taper reamers
24	1 1/32 x 16" " " " "
24	1 3/32 x 16" " " " "
72	

The above material inspected and checked by me and found to be in accordance with specifications and drawings.

John Doe Foreman.

____ 19 ____

The above material received by me in good condition this date.

____ Storekeeper.

____ 19 ____

Form 5

by the toolroom foreman in regard to the shop order, they will be made on the back of Form 6.

If it is necessary for the tool department to make cross order on the blacksmith shop for any operation on this particular order, this will also appear on the back of Form 6.

Form 6 Standard.

The A.B.C. Ry. Co.

FOREMAN'S ADVICE OF WORK COMPLETED

Shop Clerk: 3/31-1916

All work chargeable to S. O. No. 500 3/3 has been completed and delivered to Storehouse

The following orders issued on Store Department for material: Requ. 130602 4/4-16-

Cross order made on ____

Material used from stock on back of this card. John Doe Foreman

(Reverse Side of Form 6.)

Material used from Mechanical Dept. Stock. Pieces lb. or Ft.	KIND.	TOTAL

Form 6.—Front and Reverse Sides

The blacksmith department will, in addition, turn in a complete report on Form 6, showing just exactly what work they have performed on the shop order.

Form 6 is then submitted to the office of superintendent of shops, where the proper distribution of labor is computed. When this is completed, the office of superintendent of shops

renders bill against the store department, showing the number of hours or the cost of the labor used in completing the shop order, also the overhead or surcharge which it will be necessary to apply on the order.

Then the material which has been completed by the tool-room foreman on shop order is turned over to the store department, accompanied by Form 5. This form is made in duplicate, one copy being sent to office of superintendent of shops and the other accompanies the finished tools to the store department.

When the tools have been turned over complete and report made to the store department, the shop-order clerk at the store department figures up the material and labor, also surcharge, and the total amount of labor and material plus the surcharge is prorated over the entire number of reamers made on the shop order. This method can be used for the manufacturing of all classes of tools, as well as for any parts of locomotives or cars, and has been found to be very accurate. We would also recommend that all tools be made at a central shop, distributing them through the store department.

THE NEW VICE-PRESIDENT

At the final session of the Master Mechanics' convention on Wednesday, Charles F. Giles was elected vice-president. Mr. Giles has been active in the work of both the Master Mechanics' and Master Car Builders' Associations for some years and is one of this year's retiring executive committee members of the Master Mechanics' Association. He is superintendent of machinery of the Louisville & Nashville and has been largely instrumental in bringing the motive power of this road up to its present standards. He is responsible for considerable original work in locomotive design, as the Louisville & Nashville designs and builds its own locomotives at the large shops at South Louisville, Ky.

Mr. Giles was born November 2, 1856, at Rowlesburg, W. Va., and entered railway service in 1873 as a machinist apprentice of the Baltimore & Ohio. He worked later as a machinist on the Texas & Pacific, Pennsylvania and Louisville & Nashville. From 1882 to 1887 he was roundhouse foreman and machine shop foreman of the last-named road, and from 1887 to October, 1902, master mechanic at Birmingham, Ala., and Pensacola, Fla. From 1902 to 1904 he was master mechanic of the main shops at South Louisville, and in 1904 was appointed assistant superintendent of machinery. In June, 1911, he was appointed superintendent of machinery, the position which he still holds.

ADDITIONAL MASTER MECHANICS' REGISTRATION

Delaney, C. A., West. Rep.; American Locomotive Co.; Traymore.
Gill, C. A., Gen. M. M.; B. & O.
Grimshaw, F. G., A. E. M. P.; Penna.
Sinnott, Wm., M. M.; B. & O.
Trout, W. S., G. F.; Long Island; Bouvier.

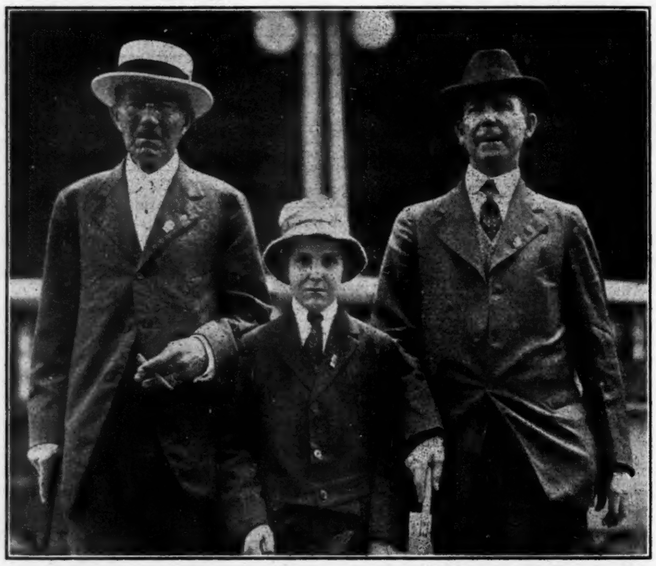
ADDITIONAL SPECIAL GUESTS

Ames, B. D., Ass't Treas.; L. & W. V.
Barnes, W. C., Ass't to C. E.; S. P.
Brown, Geo., Pur. Dept.; Penna.
Clark, J. C., Gen. For. Loco. Shop; P. & R.; Windermere.
Clement, S. B., C. E.; T. & N. O.; Chalfonte.
Cloward, T. T., Gen. For.; Penna.; Chalfonte.
Cole, Jewett, Foreman; Penna.
Cooper, H. M., Eng.; Penna.; Islesworth.
Curd, H. N., Lenoir Car Works; So. Ry.; Shelburne.
Fitz, E. M., Electric Engr.; Penna. Lines; Seaside.
Harding, C. R., C. D. Office C. E.; So. Pac.; Dennis.
Heinbach, W. F., Gen. For.; P. & R.; Lockmont.
Hoffman, G. P., Gen. Car For.; B. & O.
Illig, L. J., Chief Draftsman; Penna.
Kelley, G. W., Blacksmith For.; C. of N. J.; Worthington.
Leas, Z. J., Ass't For.; P. & R.; Walberg.
Leonard, F. A., Signal For.; W. J. & S.; Traymore.
Levee, Geo. C., Genl. Eff. Eng.; D. & H.; Pennhurst.
Rodgers, H. L., M. E.; T. & N. O.; Chalfonte.
Rommel, George, M. M.; P. & R.
Sensenbach, Chas., Foreman; Penna.; Wellsboro.
Southard, S. S., Ass't Road For. of Eng.; Penna.; Islesworth.
Stephenson, J. T., Chief Inspector; So. Ry.; Sothern.
Stoffler, Howard A., Elec. Eng.; P. & R.
Strohmer, J. S., Sec. Gen. M. M.; B. & O.; Raleigh.
Thomas, John H., Engineer; C. of N. J.; Lyric.
Van Valkenburg, H., P. W. Insp.; N. Y. C.; Chrisman.
Walbom, Morris, Foreman; Atlantic City R. R.
Weyerman, W. W., Signal Maint.; W. J. & S.
Williams, C. B., Pur. Agt.; C. of N. J.; Craig Hall.
Wooster, W. J., Mech. Insp.; Texas Pac.
Wright, N. P., Supt.; Bellefonte Cent.; Chalfonte.
Zell, J. J., M. P. Insp.; Penna.

Conventionalities

Dan Brady was delayed on reaching Atlantic City because of illness. He arrived in good time, however, to prevent breaking his good record for attendance, this being his forty-third consecutive convention.

Mrs. James S. Doyle, who was operated upon for appendicitis on Sunday, is making a rapid recovery. The attack was so sudden it was found necessary to act at once, so she was taken to a hospital in Atlantic City.



Three Generations

W. T. New, General Foreman of the Southern Railway at Danville, Va.; W. E. New (his son), Master Mechanic of the Kansas City Terminal Railway at Kansas City, Mo., and his son, Fred New, who aspires to be a railroader.

Mrs. Tom Mount and Tom Junior drove over from their summer home at Asbury Park in a Hudson super-six roadster. They made the 89 miles in 3½ hours and were hitting on all six cylinders when they arrived Monday noon.

Harry Oatley, of the Locomotive Superheater Company, in a conversation with a railroad man recently settled one of the questions relative to superheater design which has been the cause of considerable curiosity to certain inquiring minds. They were on the street in Philadelphia together when Mr. Oatley was asked what ratio to the total cross sectional area of tubes in the boiler the superheater flues should bear. He replied that he could best explain this point by a simple illustration and suggested that he count the number of Fords they passed while his companion counted the automobiles. With this data available it would be possible to obtain the desired ratio by dividing the number of Fords into the number of automobiles.